Scottish Crannogs.

Underwater excavation of artificial islands

with special reference to Oakbank Crannog, Loch Tay.

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Declaration.

I declare that this thesis has been composed by myself and that the work which it covers was initiated by me and was, with the assistance of many others, carried out by me. Specialist contributions pertaining to the main body of research are included in the appendices.

Major parts of this work are the results of a survey of crannogs in Loch Tay and excavations carried out underwater at Oakbank Crannog, Loch Tay between 1979 and 1983. Descriptive interim reports have been published elsewhere throughout that time (see References following page 288) but they do not cover in depth or breadth the work included here.

Abstract.

Crannogs are artificial islands found in Scottish and Irish lochs. They were built as early as the late Bronze Age and inhabited as late as the post-Mediaeval Period. Examinations, surveys and excavations were carried out, mainly on drained sites, in the nineteenth century. In the long term the early work has been neglected and the few rescue excavations from the twentieth century have added little to the general view. This study examines the shortcomings and problems of past research on Scottish crannogs and explains why the time is now right for further studies.

Past excavators indicated the excellent state of preservation of organic materials on the waterlogged sites. They ranged from textiles to timbers and if subjected to rigorous study using modern archaeological techniques a great deal of important information, not available from dry sites, could become available. The social conditions and lifestyle of past groups and communities and their domestic, agricultural and industrial skills may be seen with greater clarity. The relationship between local contemporary groups may be examined and wider regional contacts and influences become clearer.

The archaeological implications of draining totally waterlogged sites, the damage caused and the ensuing difficulties of excavation are compared with the benefits and disadvantages of excavation underwater.

In 1979 a survey of the crannogs in Loch Tay was carried out to establish the number of sites in the loch, the interrelationship of sites and their place in the landscape. The form and quality of the remains were recorded with the ultimate aim of establishing the suitability of a site for excavation. The first underwater excavation of a crannog commenced in 1980 and the three seasons of work carried out so far are discussed. The results have confirmed the excellent state of preservation of environmental and archaeological material, as indicated by past work, and this thesis reports the technical feasibility, financial viability and archaeological value of excavating crannogs underwater.

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The work at Oakbank Crannog carries on in the memory of Keith Muckelroy whose career as one of Britain's foremost maritime archaeologists was curtailed by his drowning on the site in the summer of 1980.

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Chapter One

Introduction.

1.1 General Descriptions.

A wide range of wetland sites have now been recognised in bogs and lakes throughout Europe. Some require no more than wellington boots and planks across the site to enable excavation while others are in depths of water requiring the use of diving equipment. The benefit of them all is the excellent state of preservation of organic materials which is not found on dry land sites. Potentially the most productive sites are those which have been totally submerged and are never exposed above the water since even occasional exposure is enough to cause both biological decay and mechanical damage to some extent.

Crannogs are part of the large group of sites which come under the general heading of lake-dwellings and many of them are totally submerged beneath the lochs of Scotland and Ireland. In fact a study of references to lake dwellings indicates that crannogs are restricted to these two countries. They are usually

compared to the type of Swiss lake sites called 'fascine' dwellings as defined by Ferdinand Keller in 1866 but research has shown that many of the Swiss sites were not built as he had proposed and were often in fact built on the side of lakes, not in the water, while the crannogs, according to evidence presented in this thesis, may originally have been true pile dwellings and were certainly built in open water.

The form of crannogs as they appear in the landscape now is usually either that of a small boulder island with a covering of trees or shrubs or a bare boulder mound beneath the water not usually visible from the shore. During their occupation a general description would be of a timber house, usually round, with a thatched roof, surrounded by a wooden walkway and possibly a stockade. A jetty or harbour may have been appended and/or a gangway may have led to the shore (fig 1).

Sufficient work has not yet been carried out on the recognition and survey of crannogs to enable the formation of a clear definition. There is no reason to suppose that natural islands were not inhabited at the same time as artificial ones and it is likely that between the two lay a range of natural sites modified to one extent or another by man. At what point does a modified natural island become a crannog? The question cannot be answered at the present time and since the cultural implications of an examination of the whole range of sites is more important than mere descriptive distinctions it may never be particularly relevant.

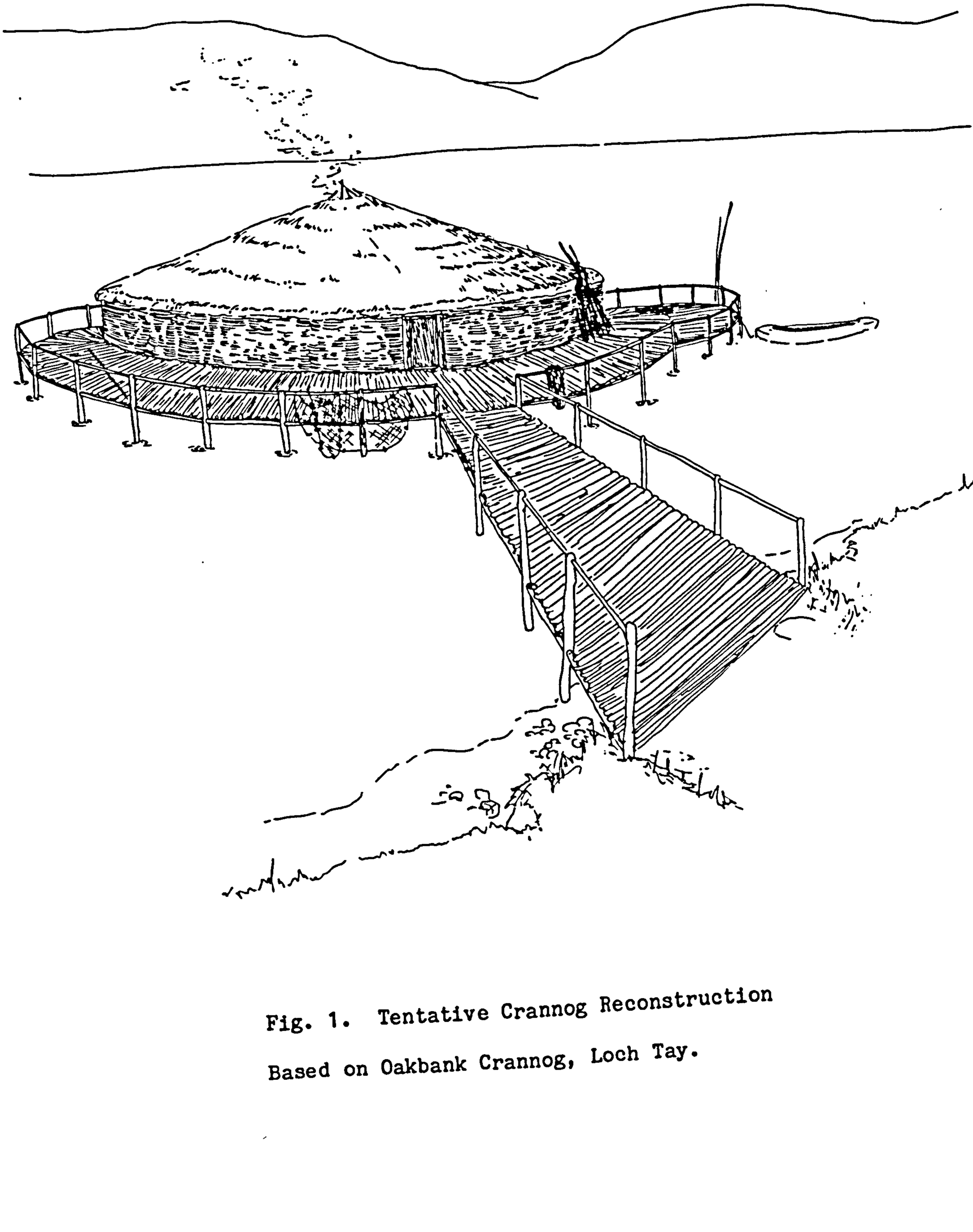


Fig. 1. Tentative Crannog Reconstruction

Based on Oakbank Crannog, Loch Tay.

It is also not possible to construct a classification of crannogs due to the lack of data relating to their form or function. Past researchers suggested a clear distinction between stone and timber-based sites but Chapter 10 of this work indicates by the results of excavation that both timber and stone phases are found on the same site and that the boulder cover which is the criterion for defining stone crannogs is a result of rebuilding or modifying existing timber crannogs. In fact, the structural sequences postulated in the past are questioned and alternatives are proposed.

Other sites exist in Scotland which at first sight may not appear to be crannogs but unless their foundations are examined there is no certainty that they were not constructed upon the remains of earlier artificial islands. These sites include some duns, brochs and mediaeval stone castles all of which are found in Scottish lochs and are exemplified by Dun Breinish, Loch an Duin, North Uist (Blundell 1913, fig 20), Clickhimmin Broch, Shetland (Hamilton 1968) and Loch Doon Castle, Ayrshire (Fairbairn 1936). These substantial stone sites may have required solid bedrock for a firm foundation but evidence from elsewhere suggests that this is not necessarily so. An island in the Loch of Kinellan, Inverness-shire, covering an area of about half an acre supported substantial stone buildings which were inhabited up to the late mediaeval period yet excavation showed that the main part of the island's foundation consisted of the remains of earlier timber structures and that it was completely

artificial (Fraser 1917).

For the purposes of this work a crannog is considered to be any artificial or mainly artificial island which does not readily encroach upon the criteria defining other types of site such as those mentioned above. It is accepted that crannog remains may underlie these and other classes of monument and that this may be demonstrated by survey or excavation in the future. Such a tenuous definition is hardly satisfactory but until more work is carried out in this field it is not considered reasonable or possible to be more exact.

Crannogs are usually placed under the heading of lake dwellings and are seen as being in some way related to other sites throughout Europe with a lacustrine connection, no matter how tenuous. A brief outline of the sort of sites which are generally accepted as lake dwellings in Britain and on the Continent will show their diversity and their contrast with crannogs in almost every case.

1.1 Ireland

The only other country where crannogs have definitely been identified is Ireland, with four hundred sites known by 1951 (Raftery 1951, 37). There is little doubt that many of the Scottish and Irish sites are similar according to the many

observations and a number of excavations which have been carried out this century. Systematic work was carried out by H.O. Hencken in the 1930s and '40s with excavations at Lagore and Balinderry crannogs (Hencken 1937, 1942, 1951) but overall the evidence from Ireland is diverse and confused. Sites date from possibly the Neolithic and certainly the Bronze Age as in the case of Lough Eskragh, Co. Tyrone (Williams 1978) and were used extensively according to historical references in the mediaeval period. A recent paper (Lynn 1983) suggests that there is insufficient evidence to date any of the Irish crannogs before 600 AD. Since a number of Scottish sites have radiocarbon dates in the first five centuries of the first millenium BC it would seem unlikely that similar types of site in Ireland were only constructed so much later.

However, most of the Irish crannogs fall into the early Christian period and in this group are some very rich sites including the royal centre of Lagore which was the first crannog ever to be examined in archaeological terms in 1839 (Wilde 1840) and was comprehensively excavated by Hencken (1950, 1-248). The wealth of finds from the site and the complexity of structural features are more than can be adequately covered here.

It is not possible from the quality of the evidence so far available to establish the range of types of lake dwelling found in Ireland but it seems to range from free-standing pile dwellings to lakeside dwellings built on the edges of the loughs and later inundated. The latter are well displayed at Lough

Eskragh, Co. Tyrone (Williams 1978) where both crannogs and lakeside sites are in evidence but the number and position of habitation areas in the waters around the edge of the lough suggest that it may have been smaller during earlier periods at which time these sites would have been at the water's edge.

The temporal range, the variety of form and the sheer quantity of the Irish sites makes it impossible to do more than indicate the potential of the material. Little systematic work is going on there at the moment but the potential of these sites for work to modern standards is clear.

1.2 England and Wales

A number of so-called pile dwellings have been recorded from England but none of them, on examination of the literature, indicate the existence of sites like crannogs. A number of small meres in Suffolk and Norfolk when drained in the past have been shown to have bones of animals and piles embedded in the bottom (Munro 1882, 290) but no reports of distinct timber-framed mounds are recorded. A site at Barmston, Holderness, East Yorkshire was regarded as a pile structure and possible lake-dwelling (Munro 1882, 301) but Varley, who excavated it recently did not accept the lake-dwelling label (1968).

The important and extensive Iron Age sites of Glastonbury and Meare in the Somerset Levels have been shown through recent evaluation to have been built on areas of peat, in the case of Meare some distance from open water (Avery 1968, Tratman 1970, Clarke 1972). These were extensive villages without the form of artificial islands and possibly with a wider diversity of functions than the great majority of crannogs. Their occupation at a time when Scottish sites were also in use emphasises a general exploitation of abundant wetlands at that time and the fact that such sites did not apparently persist in England long after the first two centuries of the first millenium AD points as much to substantial changes in the landscape as to cultural developments.

A site first reported in the nineteenth century in Llangorse Lake, Brecon, Wales is the only reference that indicates a possible crannog. The site was apparently an island in the lake with a stockade, timber floor and deposits of charcoal and food-refuse (Munro 1890, 464). There is no record of the site being examined subsequently and only field survey would establish whether it was a crannog.

1.3 Continental lake-dwellings

In continental Europe a large number of wetland sites have been discovered in recent years and work has continued on many of the sites recognised in the nineteenth century (Munro 1890).

The most commonly recorded lake-dwellings and those which are best known are the sites in Switzerland. As early as the seventeenth century fishermen and antiquarians knew of the existence of masses of timbers in many locations and often collected antiquities from the lake-bed with the use of forked poles. However, it was in 1854 when the lake levels fell unusually low that the full extent of the sites and the well-preserved archaeological material from them was realised. They were originally reconstructed by Ferdinand Keller as free-standing pile dwellings built over the water and isolated from the shore except for a wooden gangway (Keller 1866, 3 - 8).

A great deal of research has been carried out regarding the Swiss sites and it is now clear that they were in fact built and rebuilt during a number of periods on the sides of the lakes and were never surrounded by open water except during floods at which time they were abandoned (Ruoff 1980, 148). There is therefore little in terms of structural comparability with the Scottish and Irish sites and Dr. Ruoff who has been intimately involved in the Swiss work for over twenty years admits to never having seen a site like a Scottish crannog in Swiss waters (pers. comm.).

The great majority of lake-dwellings so far discovered in Europe compare with the Swiss sites and contrast with the crannogs but a discovery at Fiave, Trentino, Italy, shows that free-standing pile structures did exist in the Bronze Age (Ruoff 1980, 149). A timber platform supported by piles extended from a small island into the lake. But even in this case the site is an appendage to an existing natural feature and built from a different concept than the crannogs.

Crannogs were once seen as western outliers of the Central European lake-dwelling group but they can now be viewed as a type of site restricted in distribution to Scotland and Ireland and therefore important in clarifying the cultural development of the people in these countries. The construction of crannogs is no longer seen as a borrowing from outside but as a concept initiated and developed by the indigenous population.

Chapter Two

Scottish Crannogs: Background

Much of the evidence from crannogs points to their use as secure settlements with an economy based on agriculture. A range of craft industries was also carried on. This general description could be applied to many of the small settlement sites such as brochs, duns, palisaded settlements and hut-circles found throughout Scotland so the evidence from one type may well be of relevance to the understanding of others. However, the size of crannogs varies much more than most of the other sites and it may be that in cases where large and small crannogs are found in close proximity, as in the case of Loch Tay described below (Chapter Eight), some evidence of specialised functions or social structure may be implied.

The fact that farming was carried out is shown by numerous finds of querns, pollens of cereal and weeds of cultivation and well-preserved ards for tilling the ground from Milton Loch (Piggott 1953, 143) and Oakbank crannog (see Chapter 11). Animal bones indicate on many sites the type of animals kept and their exploitation for food, textiles and implements of bone and horn. Craft industries ranged from spinning and weaving shown by spindle whorls and loom weights, to carpentry and joinery in both the tools and the results in the form of wooden artefacts and

structural timbers. Metalworking, probably small-scale smithing since ore smelting would be too complex and dangerous on a timber island, is displayed in the form of crucibles, slag and in the case of Buston crannog in Ayrshire, globules of gold. This may imply both mining and smelting on shore sites associated with the crannogs.

Results of work in the nineteenth century indicated the use of crannogs from the Roman Iron Age to the mediaeval period but modern research shows that they were built as early as the late Bronze Age in Scotland (see below Appendix H). Radiocarbon dates and finds testify to occupation from the seventh or eighth centuries BC to the seventeenth century AD and at almost every stage between these dates. Although many of the later sites were substantially stone-built, for most of the time the artificial islands supported timber structures. Crannogs seem to have been the longest-lasting type of defended homestead in Britain. It is likely that the protection they were built to offer was as much for the defence of livestock from wolves, bears and wild cats as it was for the safety of the humans. It may also have been to store grain in rodent-free conditions.

The question is raised whether the islands were early constructions from a particular period on which a dwelling was built in later times of conflict or whether the skill of constructing artificial islands in timber was passed down through the ages presumably until the seventeenth century when they ceased to be used. No clear evidence has been derived from past

work as to the initial date of construction though many sites chronologically assigned by the dating of finds from occupation phases were probably built at much earlier periods than indicated. This is clearly shown in the case of Milton Loch Crannog (Piggott 1953) which is discussed in Chapters 4 and 5.

The reasons why people would go to the trouble of building artificial islands in water sometimes more than 8 m deep may be more than for safety alone. The location of many crannogs suggests that they were deliberately sited off an area of cultivable land. It may have been necessary to clear woodland and shrubs before cultivation could begin and the cut timbers would supply the material for building the crannog. In order to utilise the cleared ground as soon as possible a house which did not encroach upon that ground would be an advantage. The task of transporting timbers to the site would be easier if they could be floated out and the continuing problem of transportation around the edge of the steep-sided loch for hunting, fishing and wild-fowling would also be diminished if water transport was used.

Past work led to the conclusion that crannogs were concentrated in the south-west of Scotland but this is now seen as related to the emphasis of archaeological work in that area and modern survey shows that the concentration in the highlands is no less than in the lowlands (see below, Chapters 8 and 9). Since lochs have not in many cases been affected by industrial development in the same way as on land, it is almost certain that

a higher percentage of crannogs than land sites will be preserved. Although lochs were drained, particularly in the eighteenth and nineteenth centuries, for agricultural purposes there is likely to have been much less overall destruction than on good cultivable soils.

Another important aspect of the wide distribution of crannogs is that they are shown to overlie the boundaries of accepted artificial and natural divisions of Scotland. They are found in both the highland and lowland areas as has already been stated, but they are also found in three of the four provinces described by Piggott (1966) and may provide tests for the accuracy of such divisions in cultural terms since not only will exotic durables be conserved but also a wide range of domestic paraphernalia made of wood and other organic materials.

One of the most important aspects of the remains of artificial islands is that because they are in or more often under water organic materials from delicate textiles to massive timbers are in an excellent state of preservation. The importance of wood not only to prehistoric communities but up to the recent past and the great number of domestic and industrial tools and implements made of wood which would have been commonly used has been recognised (Coles 1982, 1-6). However, few sites can offer the conditions required for preservation. The number and distribution of crannogs means that a great range of well-preserved material is now available for future study.

A brief appraisal of the modern archaeological literature will show that crannogs as either a wide ranging group of settlement sites or repositories of well-preserved organic material are hardly mentioned. This was not always the case. In the late nineteenth century when Robert Munro was at his peak and concentrating on crannogs they were an important and well-recognised type of site. By 1914 the subject of lake dwellings was considered important enough to justify an entry of more than 17,000 words in the Encyclopedia of Religion and Ethics. In 1935 and 1940 in The Prehistory of Scotland and Prehistoric Communities of the British Isles, Childe still saw crannogs as a significant element in the archaeological record though in the 1940 volume he was laying the emphasis on the rich Irish sites and Glastonbury.

In 1949 Stuart Piggott in British Prehistory referred to crannogs as circular houses on a platform of timber and brushwood '...in the Glastonbury manner, but a sufficiently obvious and common technique to have little or no cultural significance' (p. 183). The references to crannogs were in terms of their similarity to sites in the Isle of Man, Ireland and England and by 1962 in The Prehistoric Peoples of Scotland he made no reference at all to crannogs. In the last twenty years few writers have considered crannogs. Alcock, as a specialist in the Dark Ages, discussed them in Arthur's Britain, but emphasised their wealth and the Irish royal sites in particular (p. 257). It is notable that all of the archaeologists writing in the

twentieth century describe crannogs in the terms laid out by Robert Munro in Ancient Scottish Lake Dwellings (1882). This has always been and still is the standard work on the subject.

The reason why interest in crannogs fell off after the 1940s and why they still receive such little consideration is easy to understand. In the thirties when Childe was writing the work of Munro was still considered with some reverence but by the sixties modern methods and techniques had thrown suspicion upon the primitive methods of early archaeologists. No systematic studies on the subject have replaced Munro's work so rather than court contention by still quoting research based on questionable methods the subject was left open. And the reason why no modern systematic research has been carried out on crannogs is because they are still islands surrounded by water or are totally submerged.

There are various reasons why the time is right for further work on the artificial islands of Scotland. Recent survey work and reappraisal of the sites (see Chapters 8 and 9) has shown that there may be more than 500 crannogs throughout the country. To consider the settlement pattern and cultural development of prehistoric Scotland without including such a large number of settlement sites is likely to produce a lack of credibility in the results. The watery location of the crannogs has restrained researchers throughout the twentieth century but modern developments in the consideration of submerged sites now make it possible to carry out efficient and accurate survey and

excavation underwater with the prospect of useful results. Accordingly a programme of survey and excavation was planned in Loch Tay to establish the feasibility, cost-effectiveness and archaeological value of underwater work on crannogs. The emphasis is on excavation and the results are presented below.

In Chapter Three the nineteenth century work is examined in some detail and particularly the research of Robert Munro since his is the only systematic research on the subject. It outlines his work and the conclusions which he reached regarding the origins, structure and inhabitants of Scottish crannogs. In Chapter Four the excavations of the twentieth century and the occasional surveys carried out in the last twenty years are outlined. Chapter Five considers the results of past work and the reasons why it has had no lasting impact in the archaeological record. It explains how the deficiencies of that work can now be overcome using modern methods and techniques of excavation in conjunction with developments in working underwater.

Chapters 7 and 8 detail the developments in underwater excavation up to the present and shows how they enable standards of observation, recording and interpretation of submerged sites to be as high as on land sites. The types of methods used to illustrate Oakbank Crannog, Loch Tay and its excavation, and to present it for the consideration of other archaeologists (bearing in mind that it is totally submerged and not visible from the shore) are also examined in Chapter 7. In 1979 a survey of

seventeen crannogs in Loch Tay was carried out to establish the location, form and interrelationship of the sites. The results of the survey are given in Chapter Eight and they supplied a corpus of material from which to choose a site for excavation. Chapter Nine compares and contrasts the results of the Loch Tay survey with the results of a survey of twenty crannogs in Loch Awe carried out in 1973.

In Chapters 10 and 11 the underwater excavation of Oakbank crannog in Loch Tay is discussed. The excavation is not yet complete and the aim of this work is to examine the potential of this type of work and its value in archaeological terms. Evidence that modern methods can extract more and better information from crannog excavations underwater than the researchers in the past could achieve on drained sites is presented and a range of specialist studies and their implications are covered. Chapter 12 summarises the results of the work in Loch Tay and offers an alternative to the structural sequence outlined by Munro which has been generally accepted by archaeologists to the present time. It also presents a relative chronological framework for the occupation phases recognised and outlines the range of activities inferred from the artefacts and analysis of the environmental material. Chapter 13 presents the conclusions of the research project: that the excavation of crannogs underwater is feasible in practical terms, viable in financial terms and of considerable value in archaeological terms.

Chapter Three

Early Notices of Crannogs in Scotland, Ireland and Switzerland.

3.1 Early Notices of Crannogs in Scotland

The appreciation by archaeologists of the importance of Scottish artificial islands began in 1857 with a paper read to the Society of Antiquaries of Scotland by Joseph Robertson. That paper was not published but the information it contained was included in a paper published in the Proceedings of the Society by John Stuart in 1865 (Stuart 1865). The work was stimulated by, firstly, a paper published in the Proceedings of the Royal Irish Academy by Sir W.R. Wilde in 1840 (Wilde 1840) and, secondly, by revelations in the Swiss lakes due to a drought in 1853-54. Stuart's paper is the first published systematic survey of Scottish crannogs but their existence was recorded from before and during the first decades of the nineteenth century. Most of the early references were summarised by Robert Munro in 'Ancient Scottish Lake Dwellings' (Munro 1882, Chapter II) and consisted of brief descriptions of mounds which had been uncovered during loch drainage schemes.

The Old Statistical Account of Scotland compiled in the late eighteenth century and the New Statistical Account of the early nineteenth century included a number of records. Lochrutton, Loch Kinder and Carlingwark in Kirkcudbright are mentioned in the earlier Account as is one of the highland lochs, Loch Spinie in Morayshire. Lochrutton and Loch Kinder were reported as containing islands which stand above the surface and are apparently artificial. Presumably the reporter had made specific efforts to examine the sites as the island in Lochrutton (OSA vol ii, 37) is in the middle of the loch some 200 m or more from shore. Also, he must have attempted to observe their submerged features since he records them as being constructed of large stones on foundations of oak timber frames, stating that the woodwork in Loch Kinder '...is visible when the weather is clear and calm'. (OSA Vol ii, 139) An underwater examination of the island in Lochrutton in 1979 established that oak piles and horizontal timbers are still evident on the loch bed at the base of the mound though none were observed on the surface. Most of the sites in Carlingwark Loch (OSA vol viii, 304) and the one in Loch Spinie (OSA vol x, 625) came to light when the lochs were lowered by draining.

Carlingwark is of particular interest since two islands stood above the surface prior to lowering of the water and a number of crannogs were exposed afterwards. It is not clear from the report how many submerged sites were eventually discovered but at least five seem to be referred to. (Munro 1882, 29) The

artificial nature of these islands is recorded:

> "On several of the little isles in the loch were large frames of black oak, neatly joined. There are two small isles that have been evidently formed by strong piles of wood driven into the moss and marl, on which were placed large frames of black oak. The tops of these were fully 6 feet under water before the loch was drained" (OSA vol viii, 304).

A causeway of stone led to one of the existing islands and was strengthened by oak piles which may suggest the use of timbers in the island itself. A number of canoes were found in the loch and other finds included stag's heads, a gold-plated dagger and many horse-shoes. Later finds are recorded, in particular a bronze cauldron containing implements of iron and bronze of Roman date (PSAS, vol vii, 7 and vol x, 286). The situation at Carlingwark with a number of crannogs above water and others submerged is recalled in 1863 by a report of the draining of the Loch of Dowalton, Wigtownshire where a similar situation was recorded (see below).

Loch Spinie, Morayshire, is the only crannog recorded in the Old Statistical Account from the highland area. It was described as a small artificial island '60 paces by 16' and apparently constructed of quarried stones 'bound together by crooked branches of oak' (Munro 1882, 30). The reporter suggested that '...the earth, with which it was completed, had been wholly washed off during its submersion.' Whether he is assuming that the site had been covered with earth or is stating that he has

knowledge of other similar sites where boulders are covered with earth is not clear. Since a great number of the Scottish crannogs appear to be stone-covered mounds it would be useful to know whether they had in recorded history been earth covered to give a flatter surface. This point regarding crannogs as bare boulder mounds is discussed in more detail in Chapter 12.

The New Statistical Account makes reference to two other sites in the south-west of the country. 'Firm stakes of oak and elm' were embedded in the bottom of the Loch of Boghall, Ayrshire and may represent the remains of a crannog though they are recorded as being used for fixing fishing nets (Munro 1882, 30). In the parish of Culter, Lanarkshire, in a bog was an oval mound known as Greene Knowe about 30 yards by 40 with the remains of a stone causeway leading to the shore. It was composed of stones through which a great number of piles had been driven. The piles were 3 feet long, made of oak 'of the hardest kind' and had been cut to a point with the use of a hatchet the marks of which were 'still wonderfully fresh' (NSA vol vi, 348). The fact that the oak is described as 'of the hardest kind' suggests that it may have been bog oak which would point to it having been underwater, or in the bog, for a substantial period of time.

Highland lochs are also represented in the New Statistical Account. Loch Rannoch, Perthshire, is attributed two small islands of which one is wholly artificial and founded on large beams of wood fixed to each other (NSA vol x, 539). There is reputedly a narrow causeway underwater leading to the south shore

but this was not evident during a visit in 1980. A small loch in the parish of Croy, Inverness-shire, contained two structures which came to light when it was drained (NSA vol xiv, 448). The artificial mound standing 5 feet high was discovered 'within a few yards of the shore'. Alternate strata of stones, earth and oak were observed in a structure of oak piles supporting smaller transverse beams and overlain with round stones. Finds from the site consisted of 'fragments of brass rings, pieces of pottery, and the bolt of a lock, of no ordinary size'. One hundred yards away was a circle of large, deeply driven oak piles which the reporter construed as an unfinished crannog. He thought the sites could not be places of defence as they were too close to the loch side and the established mound was overlooked by high ground. The island in the Loch of Kinellan, Ross-shire, was recorded as being based on logs of oak and having been at one time a house of strength (see Ch. 3) and remains of a stone building were reported on an artificial island in the Loch of Achilty, Ross-shire.

The above early references from the 1791-1799 and 1845 Statistical Accounts, although in most cases of a cursory nature, indicate a number of elements common to many crannogs examined then and subsequently. Most of these common elements suggested to the observer the artificiality of the island which he examined and the same features are used by modern crannog surveyors to recognise artificial islands.

Piles are often recorded, usually identified as oak, and they may be joined to transverse timbers with mortice and tenon joints. The timbers frequently described as being made of 'black oak', as in the case of the frames from Carlingwark, 'bog oak' or, as in Greene Knowe (see above) 'oak of the hardest kind'. It is not known how long oak wood has to be submerged for it to become 'bog oak' but its recognition in crannogs may point to relatively early sites. The heart of oak which is submerged turns black and can survive in open water where other, softer woods erode away. Preserved oak timbers projecting from submerged crannog mounds may be the only external evidence that they have an internal timber framework.

Timbers which are still attached to each other, such as those from the loch in the parish of Croy (see above), or those displaying the remains of mortice joints are clearly man-made but even where no joints remain there may be the evidence of tool-marks on pointed stakes such as at Greene Knowe. Many crannogs are seen as mounds of stone and even where timber is observed it is often beneath a layer of boulders such as at Lochrutton and Loch Kinder.

In many cases, although it is seldom specifically stated, the layer of stones and the underlying timbers are seen as forming a single phase of construction. The site in Loch Spinie was said to be 'composed of stones from the quarry, bound together by crooked branches of oak...' and it was implied that

the whole had been covered by a layer of earth (see above). The mound in Croy parish was 'formed of alternate strata of stones, earth and oak' with the stones on the top. The mound at Greene Knowe was found to 'consist of stones of all different kinds and sizes, which seem to have been tumbled promiscuously together without the least attempt at arrangement' (NSA vol. vi, 346) and the observer goes on 'Driven quite through this superincumbent mass are a great number of piles...' implying that the depositing of the stones preceded the driving of the piles. It will be shown in Chapter 12 that at Oakbank Crannog in Loch Tay the main underlying organic deposit incorporating a substantial timber framework preceded the overlying boulder layer by a considerable period of time (see below). This is not to say that in some case stones and timbers were not used in conjunction but indicates that this was not necessarily the case and that a false impression has been produced which suggests that the majority of sites in the primary phase had a boulder superstructure possibly with an earth surface.

The early reference to Carlingwark Loch indicates that a number of crannogs may have been inhabited in relatively close proximity in the form of a more or less united community or hamlet. The same situation was seen when the loch of Dowalton was drained in 1863 (see below) and five crannogs were exposed as well as six smaller stone covered mounds. Modern surveys of Loch Awe, in 1972, and Loch Tay, in 1979, proved the existence of twenty and seventeen definite crannogs respectively (see Chapters 8 and 9). Insufficient survey work has been carried out so far

to see if the majority of crannogs are associated one with another but many lochs are shown to have more than one site although there are also a substantial number with a single example.

Canoes are noted in many crannog reports and that was also the case with the early records. One was discovered when the loch in the parish of Croy, Inverness-shire, was drained and it was described as being of 'most beautiful workmanship'. The draining of Carlingwark also brought a number of canoes to light. The record states:

> "In several places of the loch canoes were found which appear to have been hollowed, after the manner of the American savages, with fire." (Munro 1882,29).

It is usually assumed that the vessels were used by the inhabitants of nearby crannogs but since the canoes and the dwelling places are not normally directly associated the contact is speculative. Dug-out canoes appear to have been used over a long period of time and may be found in places where there are not crannogs nearby so the relationship between particular sites and canoes unless directly associated should not be assumed although it may be established by radiocarbon or dendrochronological dating.

The early recorders of the Old and New Statistical Accounts do not evince surprise at the existence of artificial islands and occasionally refer to local traditions such as that relating to Carlingwark Loch which talks of 'a town in the loch which sank,

or was drowned' (OSA viii,304) or the statement regarding Loch Rannoch that 'This island was sometimes used as a place of safety in cases of emergency; at other times, as a place of confinement for such as rebelled against or offended the chief' (NSA x,539).

The impression may be given by later writers that artificial islands were neither known of nor considered until brought to public knowledge by the antiquarians of the second half of the nineteenth century. However, it should be remembered that many crannogs were inhabited into the mediaeval period. Some were the strongholds of chiefs, such as Priory Island in Loch Tay (see below Chapter 8) while others were reputedly the refuges of the local population in times of strife as at Loch Rannoch while others were the hiding places of robbers. An artificial island in Loch Ternate, Arisaig, was traditionally a place of refuge for criminals who, if they could get permission from the local chief and stay on the island for forty-eight hours, would be free from punishment (Blundell 1913, 290). There are many other references to local traditions which relate to islands, artificial and natural, and temporaly the reporters who recorded the information for the early Accounts were relatively close to crannogs when they were still in use. A report in 1913 refers to an old man of seventy-nine who remembered a small island being built in Loch Awe when he was ten years old (Blundell 1913, 288). This may be a reference to a site in a small bay in front of Ardanaiseig House which was possibly added to at that time (McArdle in press and below Chapter 9) rather than being built then.

It may be argued that crannogs have been utilised and known of in Scotland since the prehistoric period and that any hiatus in that continuity is more apparent than real. When lake-dwelling studies reached a peak in the last half of the nineteenth century early reports were overshadowed by that work and it appeared that they were being considered for the first time. Certainly they were being examined in detail for the first time but as integral elements of the Scottish landscape whether as settlements, ruins or the subject of folklore and tradition they were commonly accepted possibly from as early as the Bronze Age until the post-mediaeval period. Clearer evidence for the continuity of use of crannogs over a long period of time may come from future work.

An indication which points to this situation is seen in the many charters and tacks which refer to islands throughout the last millenium and their inclusion in official acts and ordinances. Records relating to the subjugation of the western Isles of Scotland state

> "That the haill houssis of defence strongholdis and cranokis in the Yllis perteining to thame and their foirsaidis sal be delyverit to his Maiestie..."
>
> (Regist. Secreti Concilii: Acta penes Machianum et Insularum Ordinem 1608-1623, pp. 4-5. Munro 1882, 19)

Although these references do not specify that the islands were artificial it seems likely that many of them may have been. A more graphic account relating to an Irish crannog is a drawing of

Lough Rough (fig. 2) by Richard Bartlett in 1602 (Norman and St Joseph 1969, 85). The site is in the process of being attacked or besieged by Mountjoy's troops which consisted of pikemen and musketeers. The crannog-dwellers also have muskets and are defending their home which has two houses, a canoe, an open frame of some sort and a wattle stockade. On shore is an enclosure with what appear to be crops standing in four small fields. The drawing appears factual and realistic and may be a relatively accurate representation of the events it is meant to portray. Whether sites analogous to this existed up to the seventeenth century in Scotland or whether the crannogs here supported only stone structures is not yet established.

3.2 Early Irish Observations

The earliest archaeological reference to a crannog is reputedly that made by Sir William R. Wilde on the remains of the substantial site at Lagore, Dunshaughlin, in Ireland (Wilde 1840, 420ff). Wilde was a surgeon and his report was intended to cover the large amount of bones from the site but he also described the structure as he saw it and the finds which were interspersed among the bones. Ditch diggers while clearing a small stream which cut through the mound had exposed a great number of bones and apparently 150 cart-loads had been sent to Scotland as manure. The bones were predominantly of cattle with smaller numbers of pigs and goats while horse, deer, ass and a

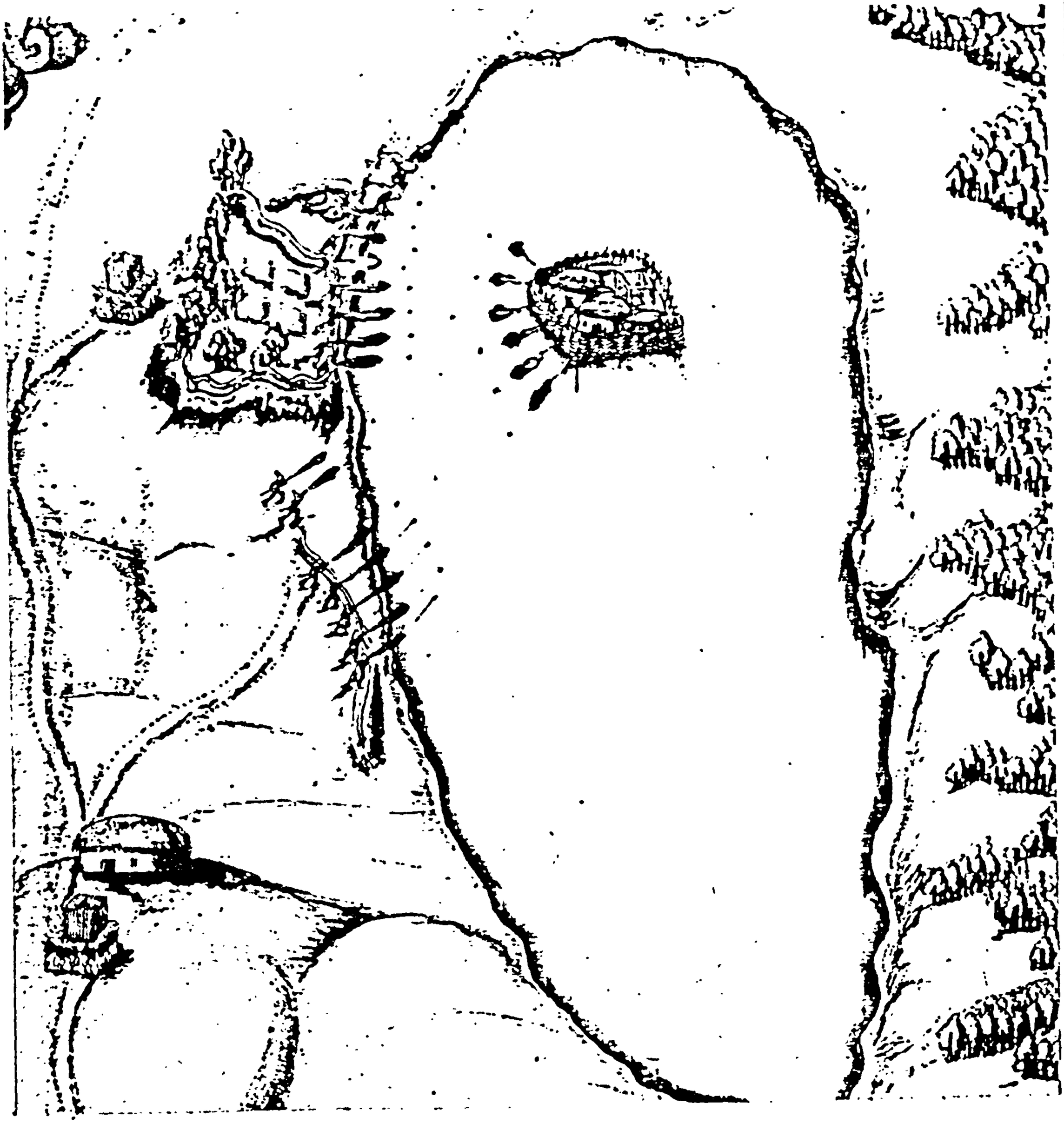


Fig. 2. Crannog in Lough Rough drawn by R. Bartlett, 1603.

Besieged by Mountjoy's troops.

number of less well-represented types were also recognised. A very large dog was an Irish wolf-dog according to Wilde. Lying among the material near the surface of the mound were two human skeletons.

The structural remains of the site consisted of a mound with 'a circumference of 520 feet standing about 8 feet high' in, and near the edge of, a bog which in living memory had been a shallow lough. The periphery of the mound was formed of upright posts of black oak, 6 - 8 feet high, which instead of being cut to a point and driven into the loch bed were morticed into beams of oak lying on the bottom 16 feet below the bog surface. The top of the posts were fixed with timber cross-pieces fastened by large iron nails. An upper layer of posts rested on the lower layer and frames of oak beams divided the area into compartments which contained the bones mixed with peat. The oak frames were well-preserved and some, according to Wilde, had rebates along the edge into which panels could be slotted to form a wall.

He divided the finds into three groups which he called the warlike, the culinary and the ornamental. In the first group were iron swords and knives, blades of spears, javelins and daggers and the boss of a shield. Tools and utensils included an axe, shears, two querns, a whetstone, iron chains, bronze bowls and three vessels described as 'resembling miniature frying pans' (Wilde 1840, 425). Spindle whorls of bone, wood and slate were turned. Pins of bronze, bone and iron were recovered, the bronze examples being 'of great beauty of construction', and brooches

and buckles were decorated with enamel and mosaic work. The writer said of the finds:

> "Several of these articles show an extraordinary state of perfection of the arts at the period of their construction."

A bone from the site had a number of interlaced and scroll motifs. carved on it 'precisely similar to those formed on ancient Irish crosses, ornaments and grave stones' and it was suggested that these were practise-pieces for carving.

Wilde's paper clearly indicated that Lagore crannog was an artificial island but also that it was unusual in the quality and quantity of finds from the site. Later excavation carried out on the site by H. Hencken in the period 1934 - 36 (Hencken 1950) uncovered a range of rich material and historical researches showed the crannog to have been a royal site housing during the seventh century AD the high-king of Ireland (Hencken 1950, 4). It was inhabited from the middle of the seventh century to the end of the tenth century.

Regardless of the wealth of material suggested by Wilde's examination of Lagore it appears that his paper and the notice of it in the Proceedings of the Royal Irish Academy in 1840 had little influence upon archaeologists in Scotland and work at the site did not continue. In 1882 Robert Munro pointed out that finds from crannogs like Dunshaughlin (Lagore), Ballinderry and Stroketown except for some articles thrown loosely into a drawer could not be identified and he stated that; 'No special or

representative collection of crannog-remains now exists in Ireland' (Munro 1882, 9). So although Wilde did maintain his interest in crannogs, and recorded forty-six sites in the Catalogue of Antiquities in the Museum of the Royal Irish Academy in 1857, systematic work did not develop in Ireland. In the ten years following Wilde's paper on Lagore a number of crannogs were discovered during draining operations twenty-two of them by the Commission for the Arterial Drainage and Inland Navigation of Ireland in the counties of Roscommon, Leitrim, Cavan and Monaghan. The rich site of Ballinderry Crannog, Co. Meath was first discovered at this time and was later excavated in the 1930s by H. Hencken and an excavation team from Harvard University (Hencken 1937). By 1886 with publication of The Lake Dwellings of Ireland by W.G. Wood-Martin over 220 crannogs were known throughout the country (Wood-Martin 1886, 250).

3.3 Early Swiss Observations

Low lake levels in Switzerland during the winter of 1853 - 54 exposed large tracts of lake bottom which were usually underwater. On and in the sediments were artifacts representing a wide range of stone, wood, bone and metal tools and implements and timber piles which were the remains of settlement structures. Study by archaeologists, and notably Ferdinand Keller (Keller 1866) resulted in the theory that platforms had been founded on uprights in open water and houses had been

constructed on the platforms for protection from enemies.

The artifacts supported for some, in particular Frederic Troyon (Troyon 1860) the relatively new three-age system of stone, bronze and iron but a too-rigid classification did not stand the test of time in terms of the Swiss lake-dwellings and ultimately it was shown that the great majority of sites dated from the Neolithic and Bronze Ages. Keller's concept of settlement sites built over open water was also rejected eventually and it has been shown that they were mostly built on the lake shores and later innundated (Ruoff 1980, 149). Nevertheless the quantity of material from Switzerland and the large number of sites (435 by 1930: Ruoff 1980, 148), ensured a prolonged interest and came to the attention of archaeologists elsewhere.

Remains of pile dwellings in Scotland were often discussed in terms of the Swiss sites and Robert Munro went so far as to theorise that:

> "...the original British Celts or Gaels were an offshoot of the founders of the Swiss lake-dwellings who emigrated to Britain..." (Munro 1886, 466).

The impression of a connection between the crannogs and the Swiss sites may have been derived from Keller's book The Lake Dwellings of Switzerland and other parts of Europe published in 1866 in which he classified three types of lake dwelling. The first were pile dwellings, which he saw as the most common type in Switzerland and northern Italy, consisting of timber framed

platforms over open water isolated from the shore but connected to it by a narrow bridge. Also in this class he included mounds of stone (steinbergs) which he said had been thrown down between the piles of the dwellings to consolidate them (Keller 1866, 4).

The second class were fascine dwellings which consisted of platforms on layers of thin branches built up from the lake-bed and held in position with upright piles (Keller 1866, 5). The third group were 'crannoges or wooden islands', which he compared closely with the fascine dwellings, restricted 'chiefly if not entirely' to Ireland and Scotland. He stated that 'the crannogs have a great analogy with the fascine dwellings of Switzerland' and that 'this similarity is very striking' (Keller 1866, 6) but his description of the construction techniques of the crannogs and his illustration (Keller 1866, 7. Fig. 3) do not entirely support these

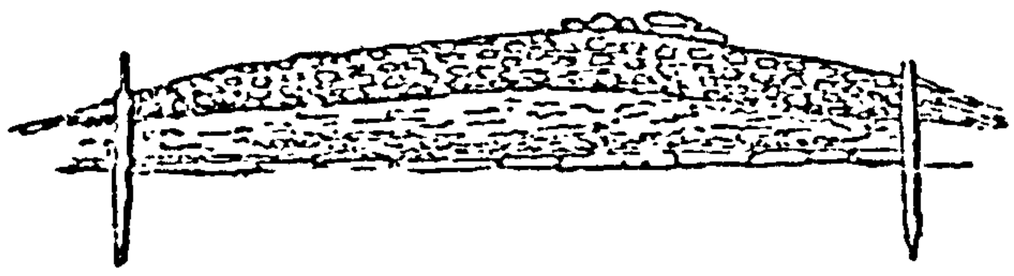


Fig. 3

statements. According to Keller the similarity was that both types of site were built up in layers from the loch bed but the crannogs were surrounded by one, two or three rows of piles in the form of a stockade and the built-up material was more complex:

"The lowest bed within this enclosure is commonly a

> mass of ferns, branches and other vegetable matter, generally covered over with a layer of round logs, cut into lengths of from four to six feet, over which is usually found a quantity of clay, gravel and stones." (Keller 1866, 6).

It will be suggested below (Chapters 10 and 12) that the sequence of layers as described by Keller was, in many cases, probably not built up from the loch bed in the crannogs but was the result of collapse of the floor of structures more like his pile-dwelling class and subsequently built up on the collapsed material. Keller's confusion was a result of his mistaken theory as to the construction of the pile dwellings in Switzerland and his second-hand knowledge of Irish and Scottish crannogs which were not fully understood by those describing them. Keller pointed out that the Swiss sites were not contemporary with those in Britain and this appeared to be the case until recently. However, modern dates from Zug, Switzerland and Oakbank, Scotland may be contemporary (Ruoff 1980,148. App. H). though the majority of Swiss sites are Neolithic and early Bronze Age and therefore much earlier than dated British sites.

Continental lake-dwellings are not restricted to Switzerland and by the end of the nineteenth century they had been recognised in many other European countries including Austria, France, Germany, Italy, Yugoslavia, Hungary and Poland (Munro 1890). The range is well covered by Robert Munro in The Lake Dwellings of Europe, 1890, which is the result of Munro's tours around the Continent to examine the sites personally. The book is a

compilation of the Rhind lectures for 1888 which he was asked to give. Many of the sites recorded by Munro may well be lake-side settlements like the Swiss examples and no clear record exists of artificial islands like the Scottish and Irish crannogs.

Lagore crannog may in some structural aspects relate to the Scottish sites but as a rich royal dwelling it is not even culturally representative of most other Irish crannogs. Many of the Irish crannogs of a less exotic nature than Lagore may be more characteristic of the Scottish ones such as those listed by Wood-Martin (1886, 163ff). A crannog in Lough Ravel, Co. Antrim according to the description accords well with many of the Scottish references. It was about 38 yards in diameter, surrounded by oak piles with morticed cross-timbers. The interior was built-up of wood and earth and flat fire-marked stones suggest the presence of a hearth. Finds from the site did not indicate particularly poor inhabitants and included wooden and copper dishes, bronze spear-heads and daggers and iron implements. Decorated glass beads and a silver brooch suggest that the inhabitants were relatively well-off compared to many Scottish sites. The author stated that finds from the site were "...sold from time to time to various collectors" (Wood-Martin 1886, 163) a practise apparently common in Ireland at the time according to the text.

The number and range of sites in Ireland and elsewhere in Europe and the artifacts from them is too great to cover adequately in this thesis. Even a selection of sites is not necessarily representative and it is of little value to the practical aspects of this work to detail elements of sites which are related to Scottish crannogs merely by being beside water. The Continental and Irish sites therefore will not be discussed further in detail except with regard to the techniques of excavating them (see Chapters 6 and 7).

Chapter 4.

Archaeological Interest in Scotland.

4.1 Nineteenth Century Work.

Many of the archaeological references to Scottish crannogs made throughout the nineteenth century are cursory with some notable exceptions. In 1854 the first volume of the Proceedings of the Society of Antiquaries of Scotland included a report of the discovery of some apparently Roman bronze vessels from the Loch of Leys, Kincardineshire. A crannog is recorded in the same loch. It was occupied by the Wauchopes then the Burnetts during the mediaeval period, probably inhabiting stone buildings at that time, but the superstructure of the island is based on oak and birch timbers (Burnett 1854, 26-27). As noted above, in 1857 Mr. Joseph Robertson read a paper to the Society of Antiquaries which was not published but inspired a number of other reports.

In the following year John Mackinlay presented, as an appendix to Robertson's paper, descriptions of two crannogs which he had examined in Bute in 1812 and 1814 respectively. The first was in Dhu Loch and was constructed of piles and transverse beams

with an infill of moss and turf and a cover of 'shingle, or quarry rubbish, to form a floor' (Mackinlay 1860, 44). On one occasion he noticed a 'framework' of timbers and on withdrawing a pile observed that it had been cut to a point (Mackinlay 1860, 45). The other island was in Loch Quein and was, according to Mackinlay, a natural structure with a stone wall around the periphery but with a double row of piles flanking a line of stones which formed a causeway to the shore (Mackinlay 1860, 45). He does not speculate as to the date of the structures or their purpose but refers to a local tradition that in times of danger the inhabitants of Bute drove their cattle to the small valley where Dhu Loch is situated.

In 1863 the remains of two crannogs were observed in a drained area of the Loch of the Clans in Nairnshire (Fig. 4. Grigor 1863). The observer recorded seeing oak timbers and branches projecting from a mound, which he referred to as a cairn, within the margin of the old loch. He construed upward sloping timbers as the rafters of an upright roof and noted a layer 'of charcoal and burnt vegetable matter, along with small bits of bone' in a part of the site which had been disturbed by the farmer (Grigor 1863, 117). He did not doubt that it was the remains of 'an insular dwelling, a wooden castle' but thought that the idea of a defensive purpose was weakened by its proximity to the shore. He suggested the possible alternatives of "...safety from the wild beasts of the surrounding forests, or for the convenience of the hunter" (Grigor 1863, 118). Fifty metres from this site he recorded another area of stones

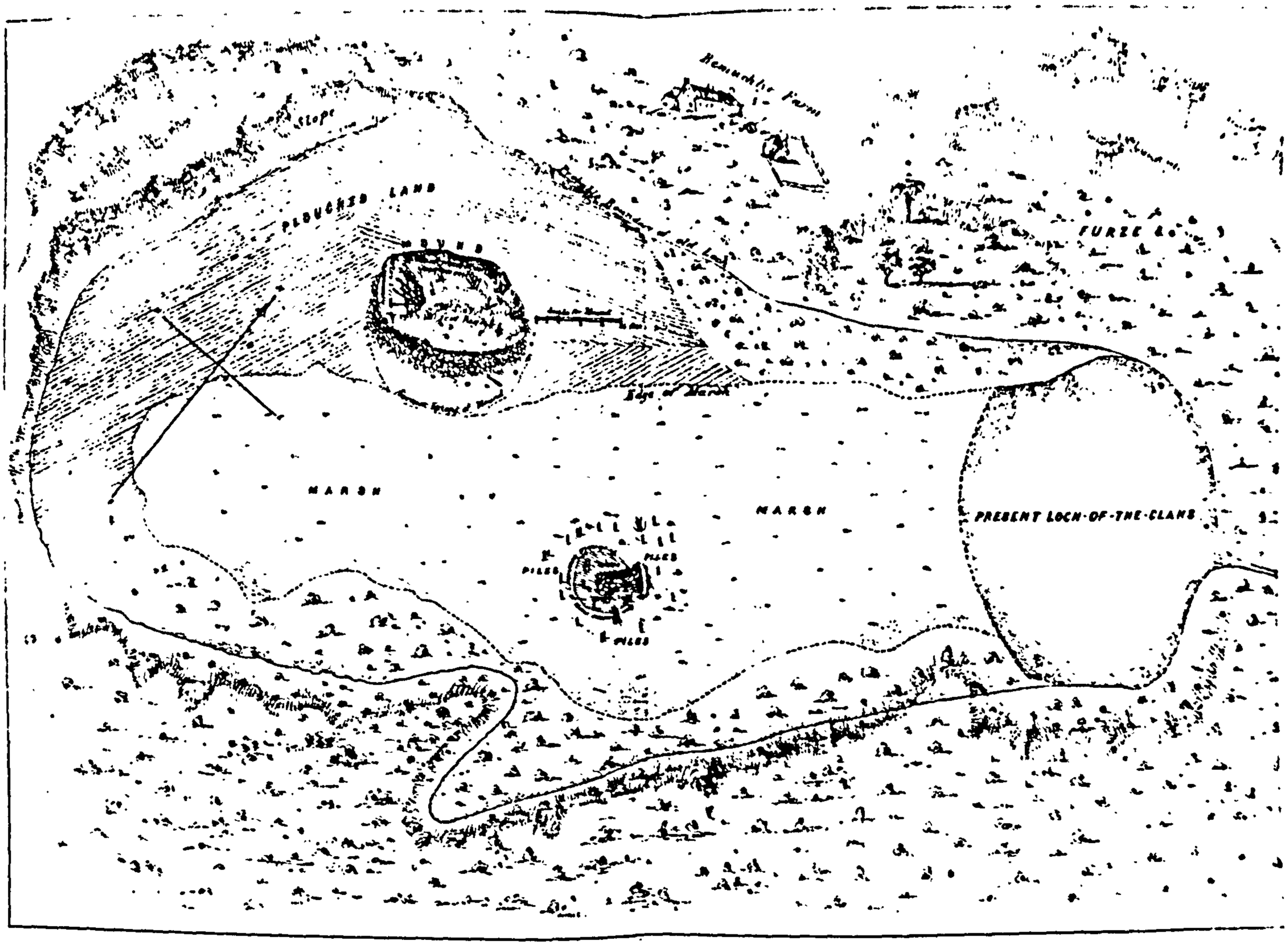
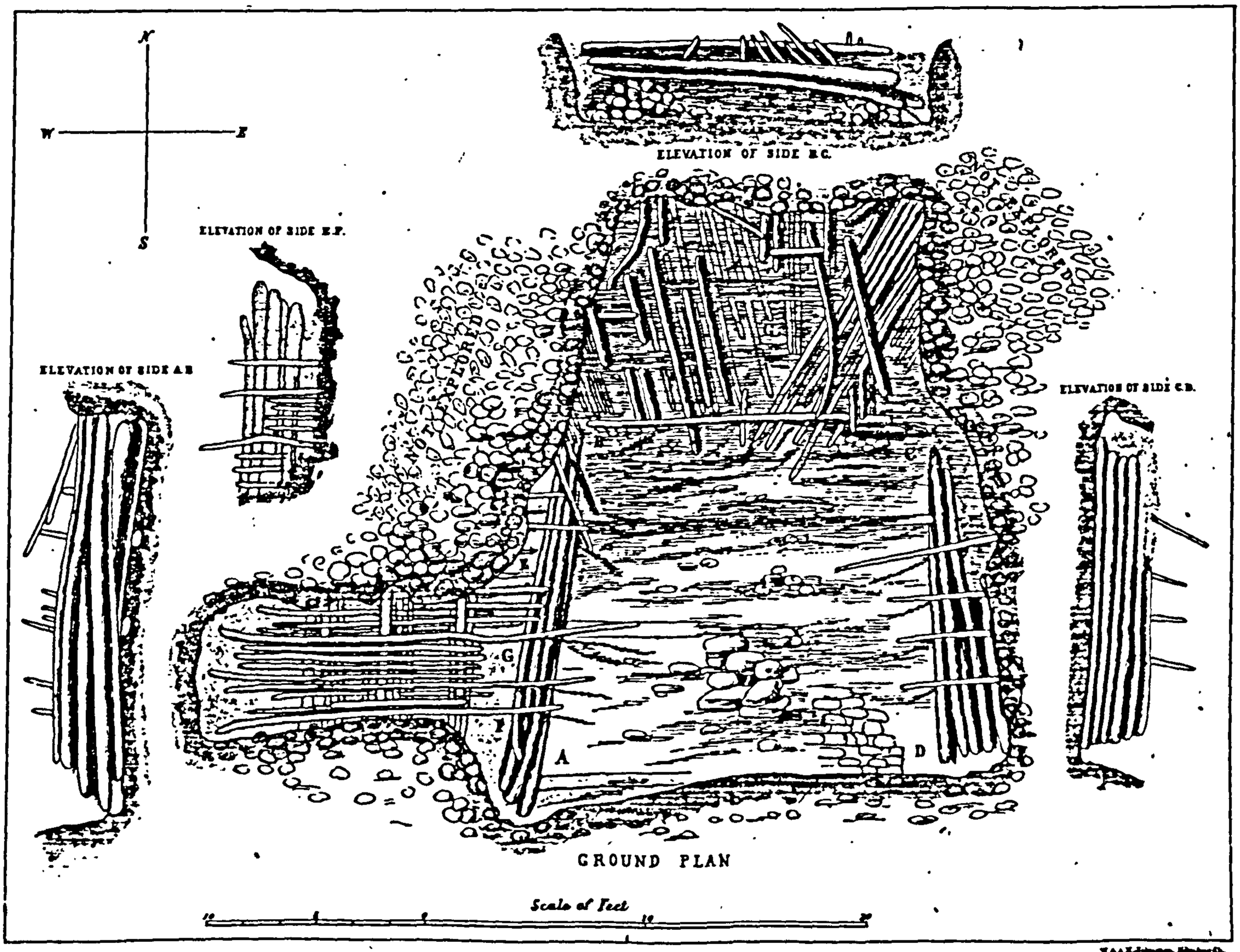


Fig. 4
Fig. 5



LARGE MOUND, — LOCH OF THE CLANS.

NAIRNSHIRE

surrounded by piles with evidence of hearth stones in the centre overlying charcoal and fragments of bone (Grigor 1863, 118).

Grigor returned to the first site later in the year to carry out excavation and established to his own satisfaction that he had indeed uncovered the rafters of a roof. Further work revealed a roughly square room with four upright walls standing about 3 feet high (Grigor 1864, 332). His published site plan (Fig. 5) indicates up to seven undressed trees, one on top of the other, to form the walls but he does not explain how they were attached to each other. The trees were oaks about thirty years old. The floor of the house was the bottom of the old loch and outside the 'walls', underneath the sloping-up rafters he found burned wood, charcoal and peat dross mixed with small seeds like buckwheat. The stones which overlay the timbers Grigor saw as holding down the ends of the rafters and strengthening the structure. He acknowledged that the foundation must have been below water and states that:

> "...the distribution of the beams and cross beams, and the remnants of beam filling below, evidently appear to have been done with the intention of keeping out the water" (Grigor 1864, 333).

He does not explain how such a system would work. He removed one of the piles from the nearby crannog which proved to be 13 feet long suggesting that a substantial deposit still existed below the waterlogged marsh at that time but could not satisfactorily explore further due to the water (Grigor 1864, 335).

It seems highly unlikely that the excavated remains of the first crannog in the Loch of the Clans was, as Grigor stated, the roof structure and walls of a house particularly with a floor on the loch bed. It is more likely to have been the substructure of an artificial island from which the superstructure has been eroded. Grigor, at that date, had seen no comparable sites and had no standards to apply to his work so it is not surprising if he misconstrued the form of the structure. This excavation was notable as the first of a crannog in Scotland. Four months later similar research was being carried out in Wigtownshire in the south-west of the country by Lord Lovaine who reported his findings to the British Association for the Advancement of Science at its 1863 meeting in Newcastle (Lovaine 1863). He examined a number of sites which had come to light when the Loch of Dowalton was drained. Four were substantial crannogs, according to his description, and six were small stone mounds which he identified as single dwellings. Two canoes were also exposed: one 24 feet and the other 18 1/2 feet long. The longer vessel was 4 feet 2 inches broad and 7 inches deep while the bottom was 2 inches thick and the shorter one was 2 feet 7 inches wide and only 2 inches of the sides remained. It had been repaired in antiquity with a block of wood pegged into the side (Lovaine 1863, 142).

When Lord Lovaine examined the sites in the Loch of Dowalton the loch-bed was still wet and muddy with standing waster in places but by 1864 the bed was dry and John Stuart, the secretary of the Society of Antiquaries of Scotland, carried out further observations and excavation. Stuart incorporated notes from the paper read by Joseph Robertson to the Society in 1857, the results of the work done in the Loch of Dowalton and all the other observations of crannogs which he could trace and produced them as a paper for the Society's proceedings in 1866 (Stuart 1865). It is recognised as the first systematic compilation of Scottish crannogs and Stuart also compares them with lake-dwellings from Ireland and the Continent.

At Dowalton he first examined a site called Millar's Cairn which demonstrated many of the features recognised in the early Scottish accounts (see above) and compared favourably with many of the Irish examples. The mound was surrounded by numerous rows of piles cut from young oak trees and at one side were

> "morticed frames of beams of oak, like hurdles, and below these, round trees laid horizontally. In some cases the vertical piles were morticed into horizontal bars. Below them, were layers of hazel and birch branches, and under these were masses of fern, the whole mixed with large boulders, and penetrated by piles. Above all, was a surface of stones and soil, which was several feet under water till the recent drainage took place. The hurdle frames were neatly

morticed together, and were secured by pegs in the mortice holes" (Stuart 1865, 116).

Three superimposed clay deposits, 'browned and calcined, as from the action of fire' were the remains of successive hearths and animal bones and wood ash were found in association.

Well-preserved organic material was noted by Stuart in the form of 'perfectly distinct' hazel leaves and nuts and hazel branches on which the bark still remained. Ferns and heather 'looked as if recently laid down' and 'In some places innumerable chrysalides of an insect occurred between the layers of fern; they are found to be those of a dipterous fly of the genus Dicara, closely allied to the "daddy long-legs".' (Stuart 1865, 116). All of the organic materials listed by Stuart and his descriptions of their state of preservation apply closely to material from the site at Oakbank in Loch Tay described in Chapter 11 (see below), including the deposits of dipterous fly puparia between layers of ferns.

Both Lord Lovaine and John Stuart remarked upon the fact that a ridge of natural bedrock near this crannog was not utilised as a solid foundation. It is noticeable in later surveys that crannogs may be constructed near to bedrock but do not utilise it. Possibly the difficulty of driving the necessary piles to support a timber framework prohibited the use of bedrock though it had been incorporated in a number of substantially timber structures in Loch Awe (see below Chapters 8 and 9).

Although this site was the only one recorded with remains of a causeway to the shore the other crannogs in Dowalton Loch showed basically the same constructional techniques. One of them was strengthened on the south side by a number of large oak slabs joined together with mortices of 8" x 10" and fixed to the loch bed with large piles (Stuart 1865, 117). A canoe 21 feet long and 3 feet 10 inches across was discovered underneath the superstructure of this site. Worn-out canoes have been found re-used in the structure of crannogs elsewhere (Piggott 1953, 137) but in this case the vessel was "... very complete, and in good order" and yet "...it was found in the foundations of the island, with hurdles and planks above it" (Stuart 1865, 118). Whether it had been used as a part of the structure or the hurdles and planks had collapsed on top of it is not clear. Another canoe, 24 feet long and noted by Lord Lovaine in 1863, was found between an area of stones, which Stuart interpreted as the remains of one of two jetties on another crannog, and the mound itself. Areas of stone conjecturally performing the same function have been recorded elsewhere (e.g. Loch Awe, see below, Chapter 9) but the association of a canoe with the stones in the Dowalton crannog adds weight to the supposition that they were jetties or landing places.

Animal bones from the sites in Dowalton Loch showed evidence of cattle, pigs and sheep or goats and the bone of a large bird was also seen. A number of finds from the sites and from the loch-bed included bronze dishes (one with the name CIPIPOLIE on

the handle) and glass beads pointing to a habitation phase during the Roman period. Similar bronze vessels were also discovered at Friar's Carse, Dumfriesshire where a crannog, like those at Dowalton, was discovered in 1879, though the dishes are not necessarily associated with the artificial island having been found some 89 years earlier (Dishes: Stuart 1865, 124. Crannog: Munro 1882, 152).

Stuart also records an artificial island, constructed like the ones in the Loch of Dowalton, in the nearby White Loch of Mertoun (Stuart 1865, 10), and comes to the conclusion that:

> "The general plan of construction of Scottish crannog islands, was different from that of the crannogs in the Loch of Dowalton and the White Loch of Mertoun" (Stuart 1865, 12).

He does not clearly state what the differences are but goes on to enumerate a number of sites which he describes as being built mainly of stones and earth though encircled by piles to hold the mass together (Stuart 1865, 12-16). This idea is similar to the view held by Keller (Keller 1866, 6) and prevails throughout the literature to the present time (e.g. Cunliffe 1978, 277). An alternative view is presented in Chapter 12 which although it may not apply to all Scottish crannogs is a better explanation of the circumstances observed on many sites according to their description in the literature and accords with the stratified deposits in the crannogs of the Loch of Dowalton.

Stuart was of the opinion that analogies existed between the Scottish and Irish crannogs and those at Dowalton. A point of similarity was that on shore near many of the Irish sites were raths and that shore sites would exist near Scottish crannogs as well. He gives as an example a crannog in Loch Lomond with a castle nearby (Stuart 1865, 131) but the same association is not generally seen elsewhere. He regarded crannogs from both countries as temporary refuges for the people who lived in the shore sites although he saw some artificial islands as sustaining more lengthy periods of residence by the amount of animal bone found on them and included the largest of the Dowalton crannogs in this group while recognising that it could not compare with Irish sites, like Lagore, in amounts of food refuse.

He saw parallels in the range of finds from Dowalton and the Irish sites:

> "The objects found on the Irish islands comprehend specimens of almost everything found on those at Dowalton, and show the same combination of articles of personal ornament with such homely objects as querns and the like. Querns and hones are of almost universal occurrence." (Stuart 1865, 139).

Objects which he saw in both areas included glass and amber beads, bone and wood combs, leather and implements and tools of iron and bronze.

Stuart saw few analogies between the Scottish and Swiss sites contrasting the size of the pile-dwellings in Switzerland and their permanence with the temporary nature of the Scottish dwellings and their function as occasional retreats. He saw the steinbergs of the Swiss lakes as having more in common with the British crannogs but makes no distinction between the steinbergs and fascine dwellings as Keller does in 1866 (Stuart 1865, 148. Keller 1866, 4). Stuart emphasised the basic difference between the sites in both countries:

> "Still, in the main, the use of piles in Switzerland was for the purpose of sustaining large platforms, on which whole villages were erected; while, in Scotland and Ireland, the piles were used for protecting the single solid island within them, and forming a palisade for defence round the margin of the island" (Stuart 1865, 148).

Later, he reiterated the distinctive elements of the crannogs in the Loch of Dowalton:

> "Islands, constructed of layers of vegetable substances like those in Dowalton and the neighbouring White Loch of Mertoun, have not as yet been found elsewhere in Scotland. It will be interesting to watch, in the light of future discoveries, whether this was a local use, or whether it depended on other circumstances, such as the depth of the loch, and the abundance of vegetable materials in the neighbourhood." (Stuart 1865, 154).

Within twenty years of Stuart's paper it was established that sites with substructures like those in Dowalton existed elsewhere (Munro 1882) and yet the structural techniques employed in the construction of artificial islands have not to date been satisfactorily explained; neither has the range of types. Some of the reasons for this state of affairs will be discussed later.

Notwithstanding the superficiality of the early work by the late eighteen-seventies it was generally accepted that a crannog was a basically artificial island usually with a timber and brushwood foundation supporting a house with a log floor and clay or stone hearth, possibly surrounded by a stockade and with a gangway to the shore. Boulders in or on the structure were seen as providing strength for the uprights or acting as a barrier to water erosion.

4.2 The Contribution of Robert Munro to Crannog Research.

The most systematic research on the subject of lake dwellings was carried out by Robert Munro in the last quarter of the nineteenth century. He excavated and examined a number of Scottish crannogs and travelled widely studying pile dwellings of all sorts. The results of his work were published as papers in a wide variety of journals and collected in two major publications, 'Ancient Scottish Lake Dwellings' 1882, and 'The Lake Dwellings

of Europe' 1890.

The major part of 'Ancient Scottish Lake Dwellings' consists of the results of the excavation of three Ayrshire crannogs, discovered on the farms of Lochlee, Lochspouts and Buston. These excavations were notable in that they supplied the first reasoned plans and sections of crannogs (Figs. 6 and 7). The excavations were not carried out in a manner acceptable to modern archaeological standards, a fact point which is clearly established by reference to Munro's own records.

He believed the great majority of timber crannogs to be built along the lines of the so-called 'fascine' dwellings of the Continent as described by Ferdinand Keller (Keller 1866, 5). Keller classified the typical Scottish or Irish crannog as a different type from the fascine dwellings but they are so similar as to be part of the same class.

The finds from the crannogs which he examined showed Munro a picture of people who practised farming, both crop-cultivation and stock-rearing, supplemented by hunting, fishing, shellfish and wild fruit gathering. Goose bones from Buston crannog showed that wild- fowling was also carried on.

Finds also displayed a wide range of industries including; metalworking ~~metalworking~~ in the form of crucibles and moulds (Munro 1882, 45, 138, 235, 277); spinning and weaving in the form of spindle-whorls and loom-weights (Munro 1882, 109, 172, 213);

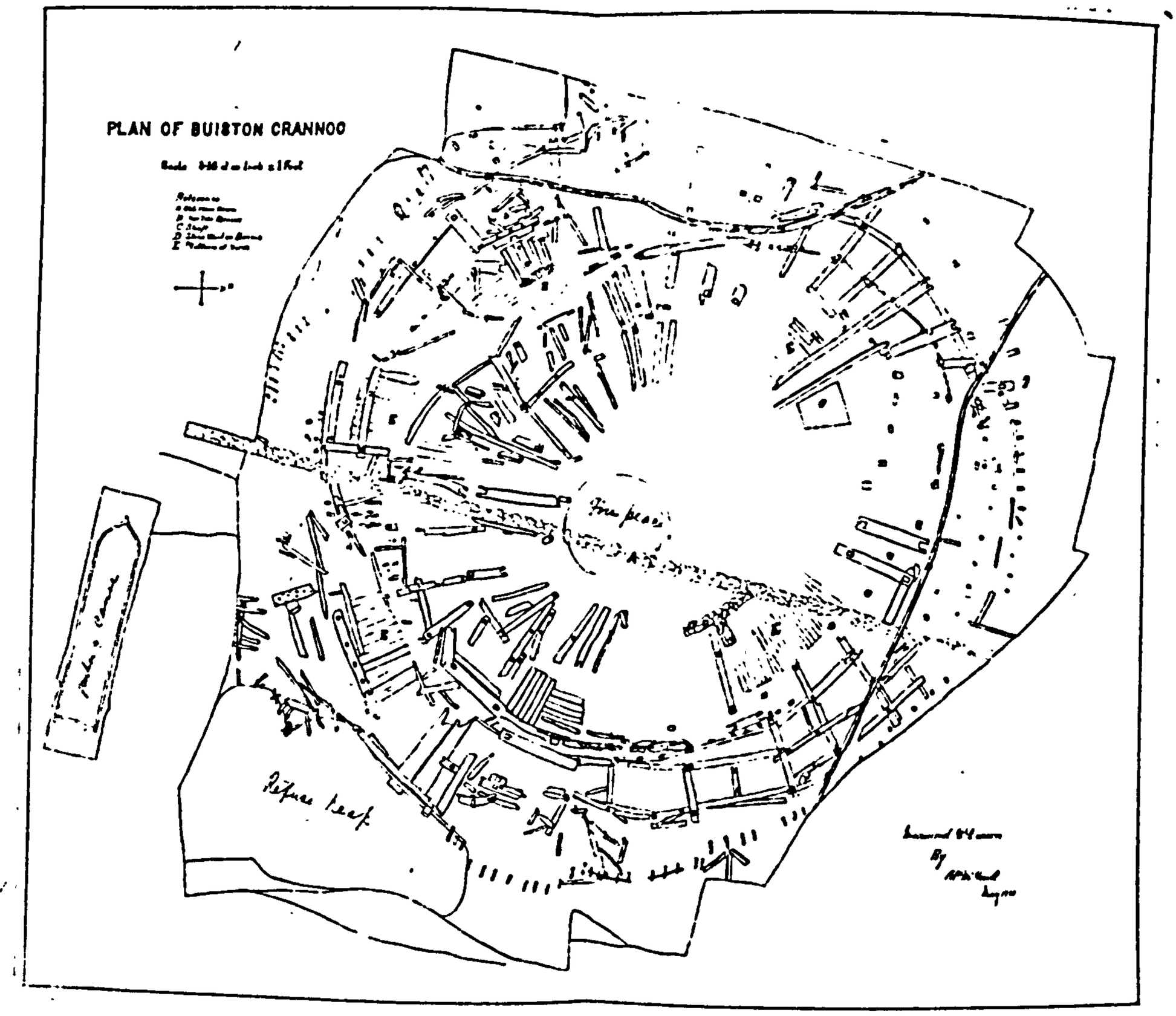
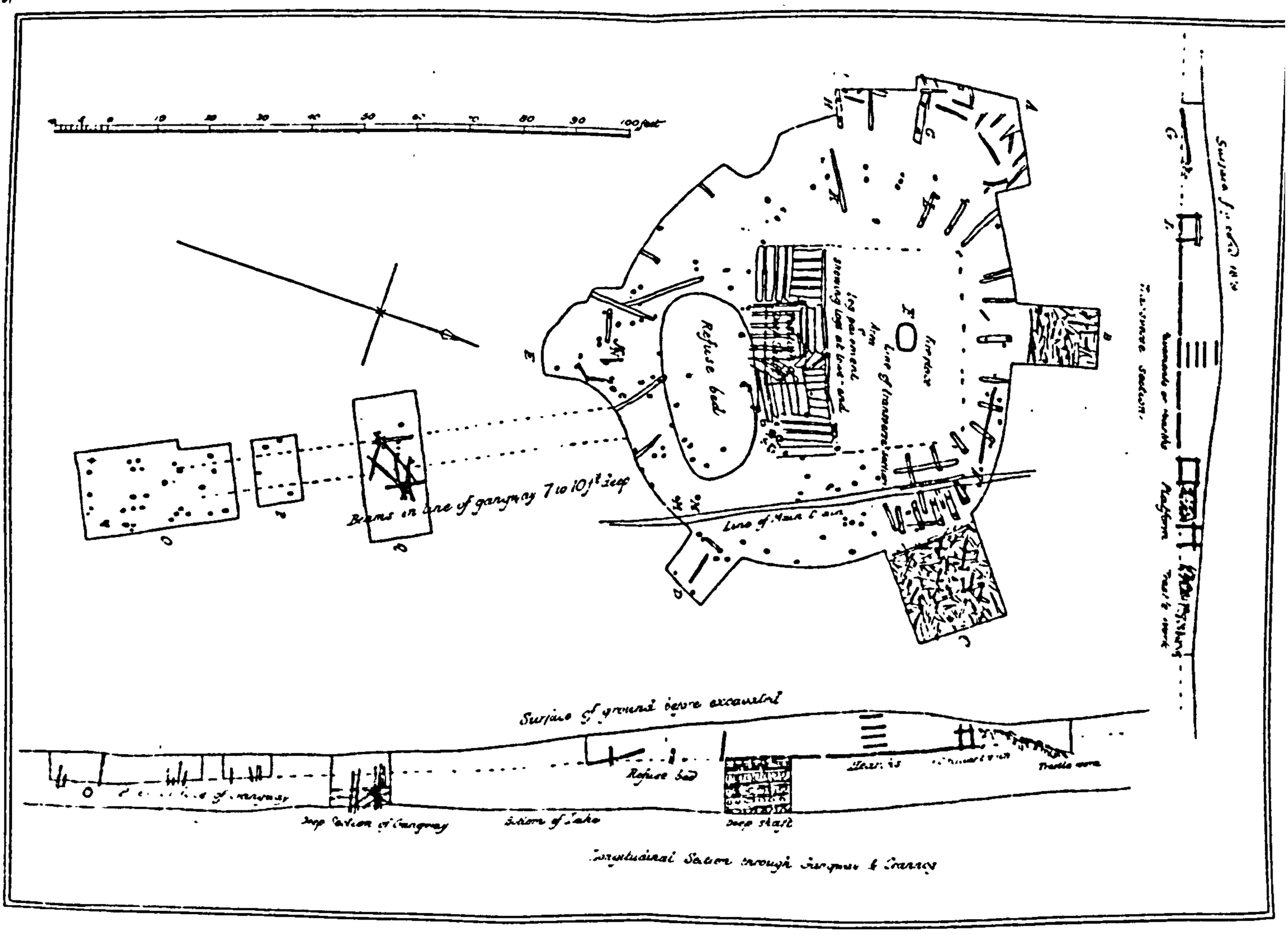


Fig. 6

Fig. 7



Plan of Lochlee Crannog.

milling by querns (Munro 1882, 213, 171, 106), and fishing as seen by net-weights and hooks.

Less industrial activities were displayed in decorative and ornamental objects such as bracelets, necklaces, rings and beads (Munro 1882, 178) and artistic motifs are represented on these and other finds like bone combs (Munro 1882, 218) and a carved wooden plaque from Lochlee (fig 8).

During the period when Munro was carrying out his work on crannogs and lake dwellings other notices were occasionally published ranging in location from the island of Mull in the Inner Hebrides (Campbell 1870, 465) to Loch Hogsetter on the island of Whalsey in the Shetlands (Mitchell 1881, 303-15). Usually these were no more than descriptions and the observers could add little or nothing to the general concepts put forward by Munro.

His involvement with crannogs brought him into the front line of the controversy, which arose in the final years of the nineteenth century and the first few years of the twentieth century, over the finds discovered in three sites in the Clyde Estuary, crannogs at Dumbuck and Langbank and at the nearby dun of Dunbuie. All three sites produced material which would fit acceptably an Iron Age date but another group of material of slate and sandstone was so unusual as to defy classification.

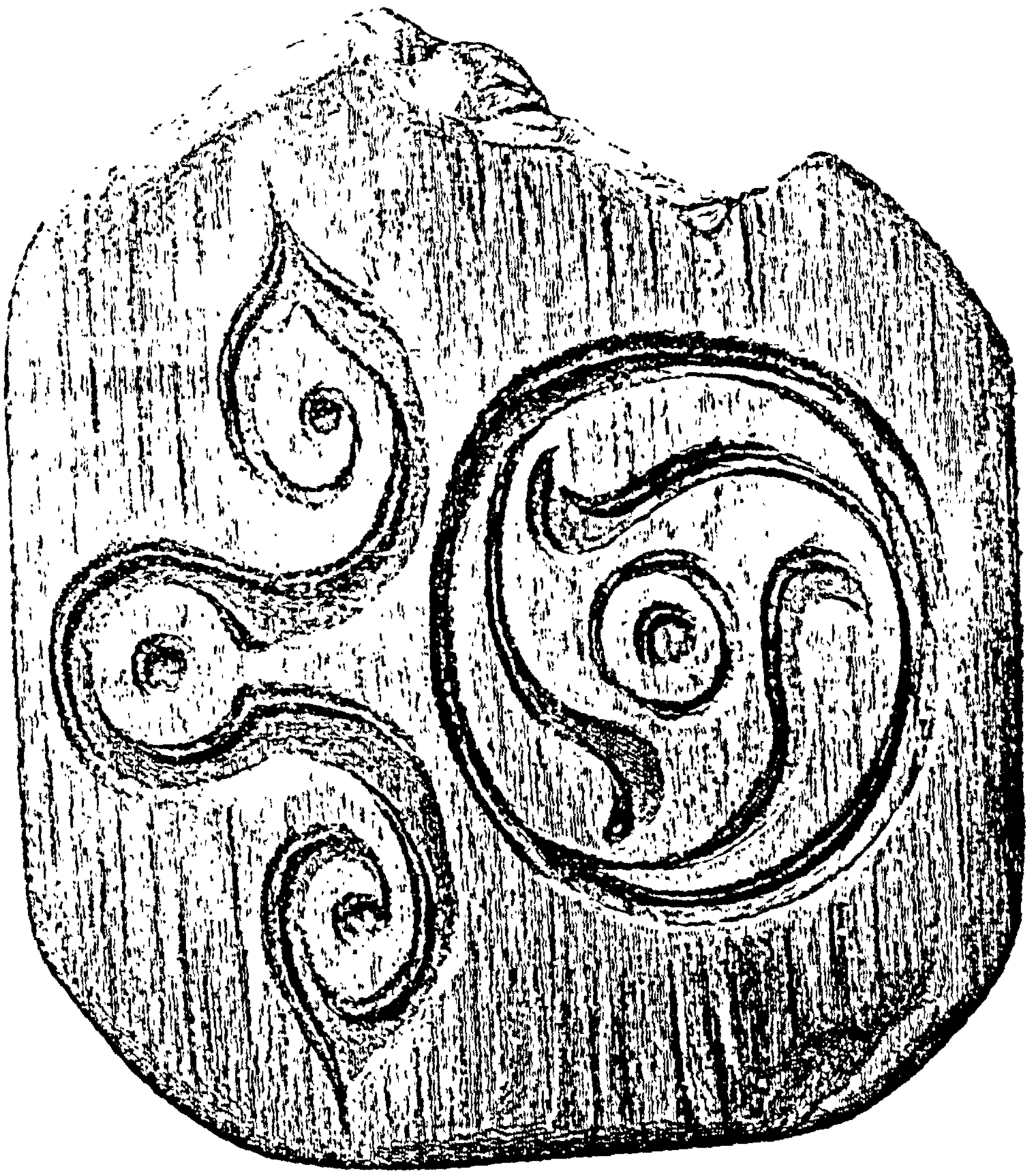
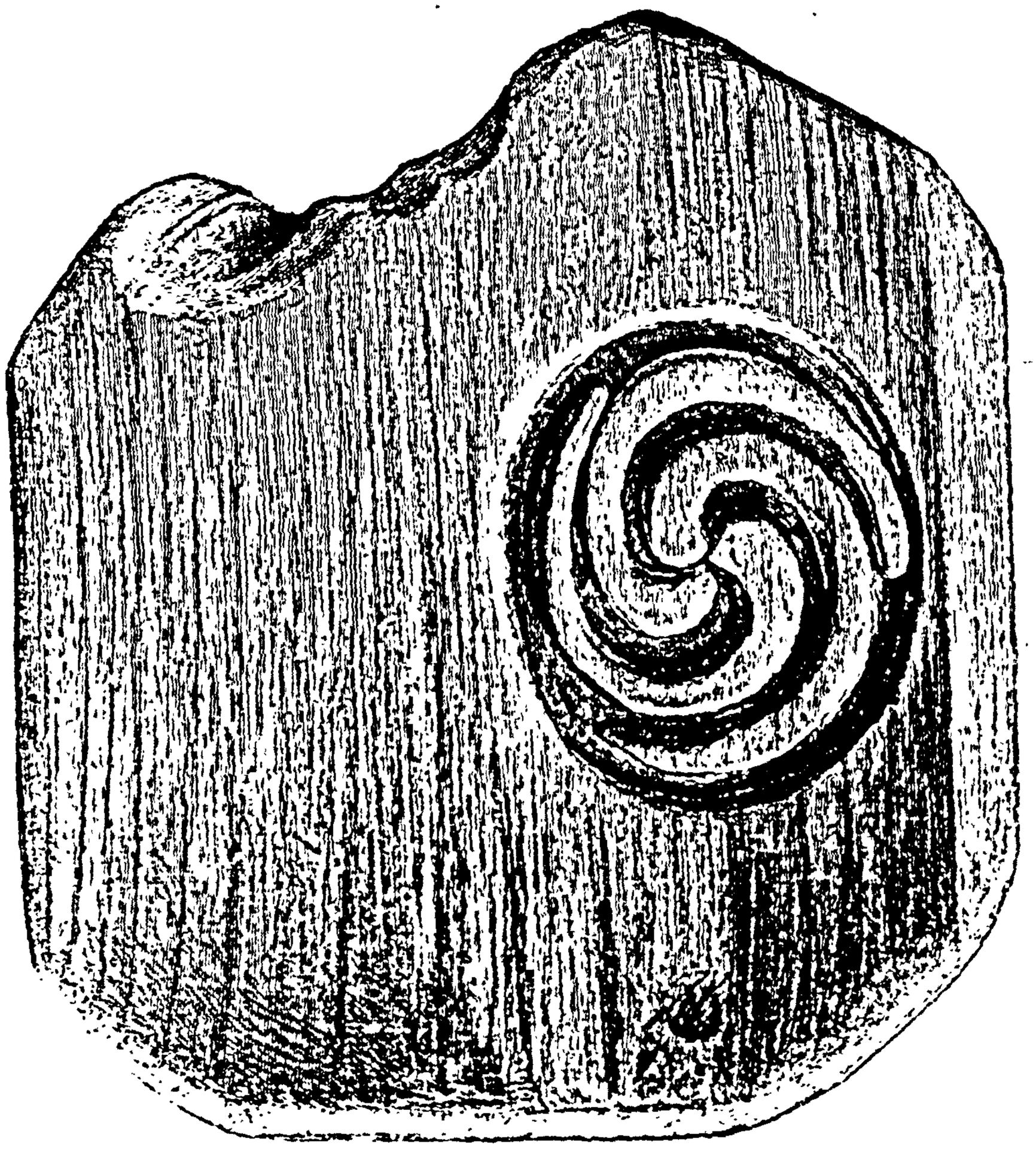


Fig. 8



Munro and other eminent archaeologists denounced these latter finds as fakes but the controversy lasted for years with the excavators and their supporters attempting to assign tho material to a Neolithic phase. Munro's arguments were clear and cogent and resulted in publication of a book entitled 'Archaeology and False Antiquities' (1905). He did not ignore the importance of the estuarine structures although he was unable to classify them as dwellings, beacons or watchtowers. He saw them as representative of a few such sites found in an estuarine situation such as that visited by him on the island of Eriskay (Munro 1885). The impact of Munro's work upon the subject of crannogs was considerable and has survived until the present time. The problems which have resulted from it will be discussed in more detail in Chapter 5.

During the twentieth century until his death in 1920 Munro published works on a wide variety of subjects and although he never relinquished his interest in crannogs he was less involved than in earlier years.

In the first fifteen years of this century a number of the artificial islands in the Highland area were examined by Rev F. O. Blundell of St Benedict's Abbey, Fort Augustus, his work eventually being carried out under the auspices of a committee of the British Association which included Robert Munro among its members.

In 1908 Blundell, for his own interest, examined two sites in Loch Ness (Blundell 1909, 159-64), both in a bay at the west end of the loch. Eilean nan Con, the smaller of the two, is now underwater due to the raising of the loch by six feet after the construction of the Caledonian Canal in the nineteenth century. Blundell thought it to be a natural island as its proximity to the shore would offer little protection and he could detect no 'artificial material' about it (Blundell 1909, 159). Eilean Muireach, or Cherry Island, he saw as a more interesting proposition and examined it by means of a diving suit borrowed from the Clyde Navigation Trust (see Ch. 6). At Blundell's instigation a Committee of the British Association was formed to 'investigate and ascertain the distribution' of crannogs in the Highlands. While he continued his personal examinations a circular was sent to many of the Highland clergy and landowners asking for information regarding sites in their parishes or on their property. From the replies more than fifty new references were added to the list made available by Munro and the earlier workers (Blundell 1909, 1910, 1913).

Finance was ultimately obtained with the aim of excavating one of the sites but before the work could commence Blundell left for the Continent as a chaplain with the British forces in the First World War. The island in the Loch of Kinellan, near Strathpeffer, was duly excavated by Mr. Hugh Fraser, a teacher from Dingwall Academy, in place of Blundell (Fraser 1917).

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The excavation was unsatisfactory, albeit with advice on the spot by Robert Munro. Fraser's strategy of digging numerous small pits on the surface of the island allowed no large scale plans of even the upper structures and made it impossible to associate elements of different features (Fraser 1915, 250-251). He was forced to excavate in this manner because the island was still surrounded by water which flooded the pits at a depth of from 3 - 4 feet below the surface of the island and the timbers of the substructure were reached c. 10 feet below the Autumn water level (Fraser 1915, 237).

After the war Blundell did not go back to his crannog researches. His work had resulted in observations and descriptions of a number of sites and established that large numbers of crannogs were to be found in the Highlands, not only in the southwest as Munro's work had tended to suggest.

The lack of success of the Kinellan excavation, the withdrawal of Blundell from the scene and finally the death of Robert Munro in 1920 saw the effective end of serious lake dwelling studies in Scotland until the nineteen-seventies. Five sites were excavated in the intervening period in every case due to exposure as a result of changes in water level for one reason or another.

4.3 Lochend Loch, Coatbridge.

In 1932, Lochend Loch, Coatbridge, was drained for cleaning and deepening. An oval crannog, measuring approximately 36m by 27m emerged some 21m from the shore. The site was excavated by workmen under the supervision of Mr Ludovic Mann and reported by James Monteith (1937, 26 -43). The remains of a central living area constructed of horizontal timbers was uncovered close to a number of vertical piles. Evidence of habitation was seen in the form of worked wood, stone discs, an upper quernstone, a portion of a jet bracelet and a group of coarse pottery characteristic of prehistoric material. A wooden shoe to support a vertical post had been pegged to the clay floor of the second habitation phase (Monteith 1937, 32).

The site was very muddy and a water pump was used much of the time to keep the trenches relatively dry. Although the standards of excavation were not up to the level required in modern archaeology a plan and two sections were published (fig. 9). This is one of the few crannogs where human bones were found. The fragments of two skeletons were uncovered. One, from the inside of the house, had been burnt and the other, from 'outside the boundary' had not. The latter showed evidence of a healed fracture of the left leg. No conclusions were reached as to the date of the site or to the economy and history of its inhabitants.

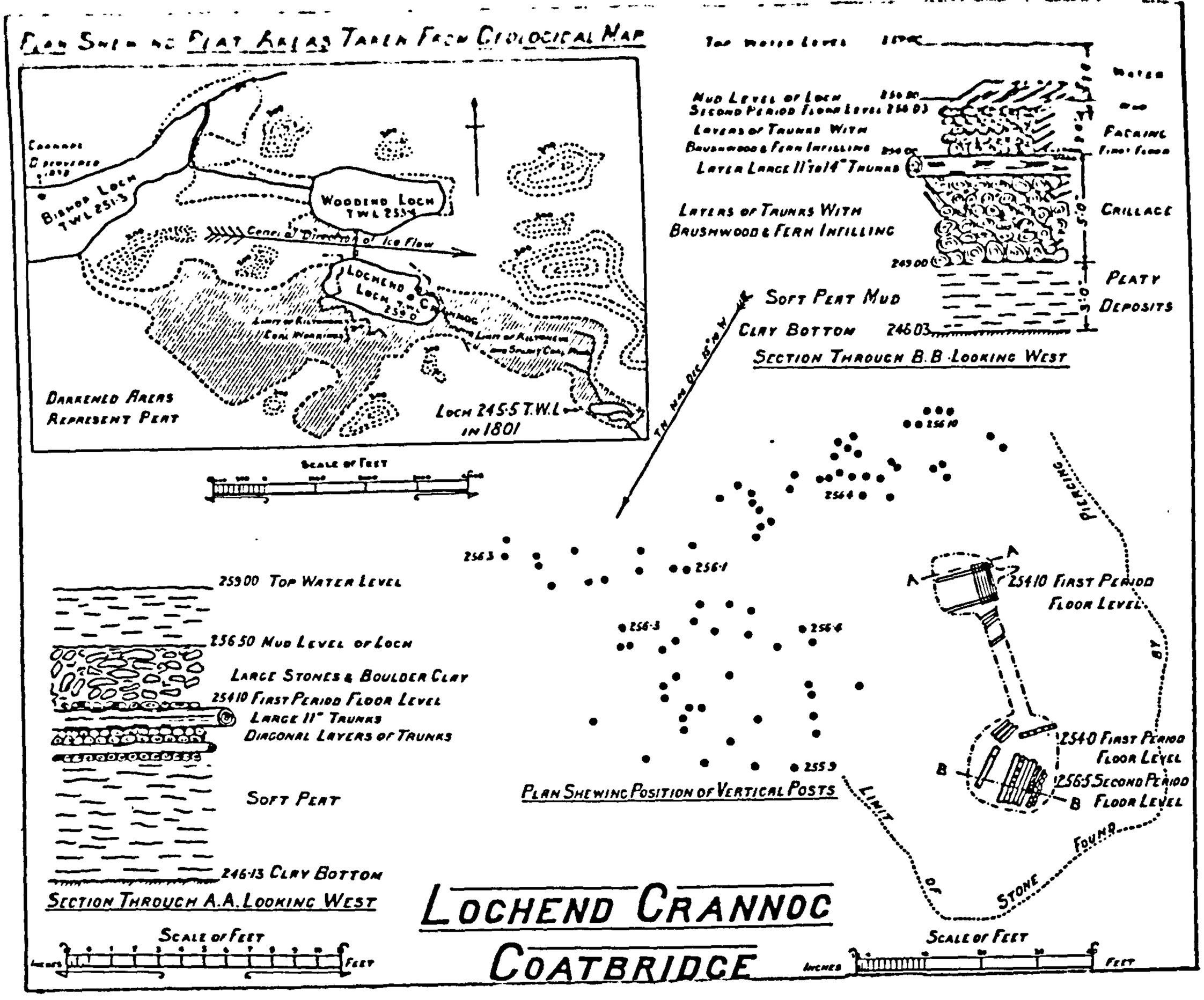
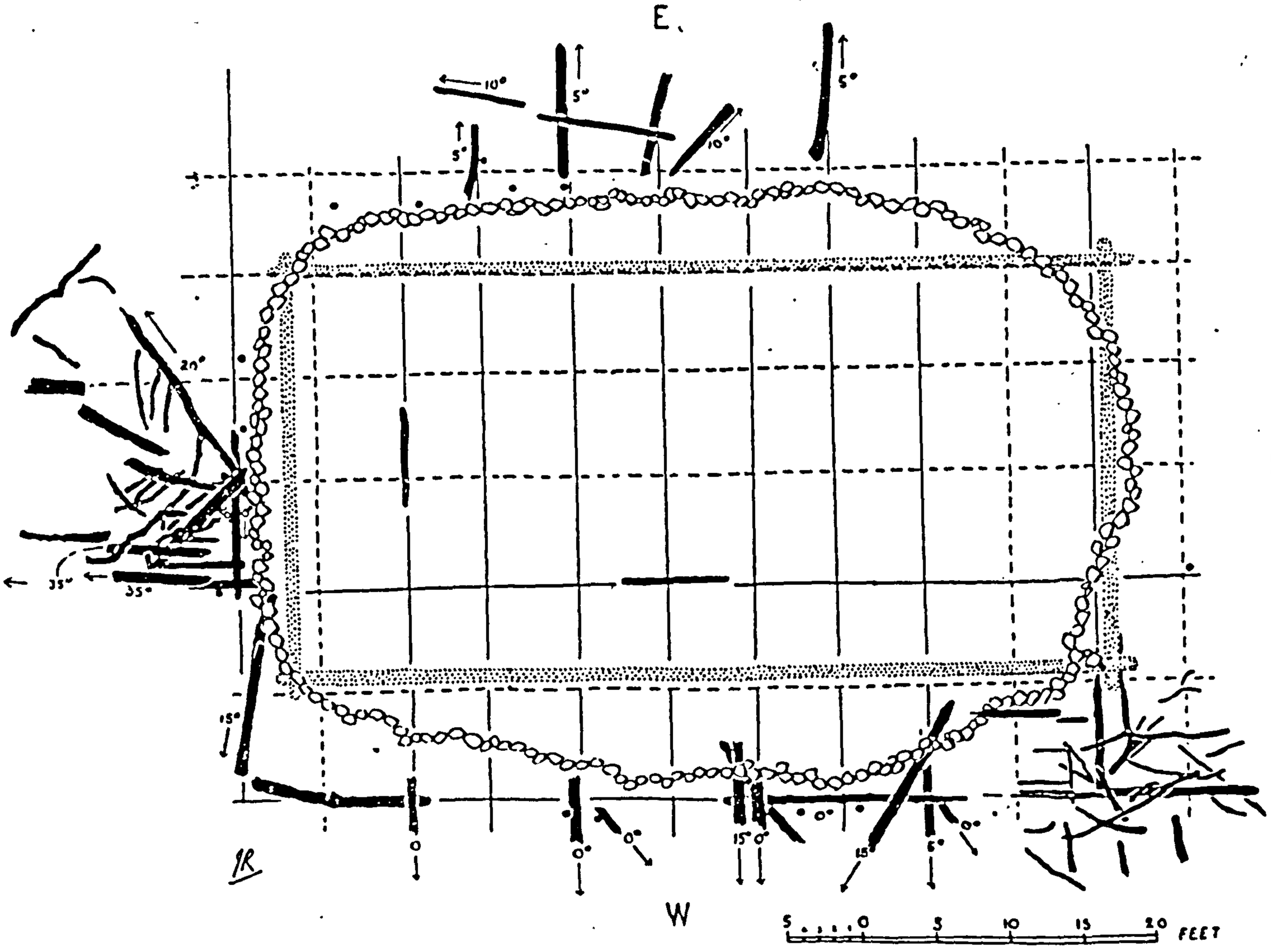

Plan Shewing Flat Areas Taken From Geological Map
Bishop Loch T.W.L 251·3
Woodend Loch T.W.L 253·4
Direction of Ice Flow
Lochend Loch T.W.L 250·0
Darkened Areas Represent Peat
Loch 245·5 T.W.L in 1801
Scale of Feet
Top Water Level 259·00
Mud Level of Loch 256·50
Large Stones & Boulder Clay
First Period Floor Level 254·10
Large 11" Trunks
Diagonal Layers of Trunks
Soft Peat
Clay Botton 246·13
Section Through A.A. Looking West
Scale of Feet
Top Water Level 259·00
Mud Level of Loch 256·50
Second Period Floor Level 256·03
Layers of Trunks With Brushwood & Fern Infilling
Layer Large 11 to 14" Trunks 254·00
Layers of Trunks With Brushwood & Fern Infilling
Soft Peat Mud
Clay Botton 246·03
Section Through B.B Looking West
Plan Shewing Position of Vertical Posts
256·3
256·1
256·2
256·4
255·9
Piering
First Period Floor Level 254·10
First Period Floor Level 254·0
Second Period Floor Level 256·5
Limit of Stone Found
Scale of Feet
Lochend Crannoc
Coatbridge

Fig. 9

Fig. 10

E.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4.4 Loch Treig, Invernessshire.

In 1933 Professor James Ritchie of Edinburgh University was informed that a crannog in Loch Treig, Invernessshire was exposed above the water level which had been dropped while the loch was dammed to supply water for the British Aluminium Company Works in Fort William. He organised and supervised excavations on the site in July of that year (Ritchie 1942, 8 - 78).

The superficially stony mound was discovered to have a core consisting substantially of layers of timbers, brushwood, peat, earth and stones. A great number of horizontal timbers were uncovered representing an upper living platform and underlying foundation structure with relatively few vertical piles compared to other excavated crannogs.

Professor Ritchie considered the site to be of a distinctive and developed construction with analogous features to other Scottish and Irish sites but with more differences than similarities. Unusually, the Loch Treig crannog, according to Ritchie, was rectangular not subcircular as characterises most other crannogs (fig. 10). Recent examination (1983 by author) shows that the crannog was not totally excavated as a substantial mound still remains (pl. 1) According to the 1942 report there was no evidence for a causeway to the shore. However, a ridge of stones is clear now and cursory examination established the existence of substantial, parallel, horizontal beams running

along the ridge close to the surface (pl. 1) The few finds from the site are from unclear contexts but insofar as they indicate any date for habitation it would be from the Mediaeval Period as late as the sixteenth or seventeenth centuries AD in the final phase (Ritchie 1942, 69). Remains of a shoe were assigned 'later than 500 AD' (Ritchie 1942, 68) and Ritchie thought it likely that the Loch Treig crannog builders lived at the end of, or soon after, Romano-British times (Ritchie 1942, 74). Further excavation for clearly associated timbers would help to clarify the situation with radiocarbon dates.

It is also recorded , in the records of the North of Scotland Hydro-Electric Board archives, that Professor Ritchie examined a crannog in Loch Garry which was exposed when the water level in the loch was lowered for hydro-electric power related work. He died before publishing the results of this work.

4.5 Milton Loch Crannog I, Kirkcudbright.

The nineteen-forties saw the substantial excavations carried out by Hencken at Lagore and Balinderry in Ireland (Hencken 1937, 1942, 1950) but no more work was carried out in Scotland until 1953 when one of two crannogs discovered in Milton Loch, Kirkcudbright was excavated by C. M. Piggott. This excavation is the closest published report to the standards required of modern archaeology, and yet conclusions were reached by the

Plate 1

Plate 2

excavator, particularly in regard to chronology, which were later proved wrong. Milton Loch was not a total excavation as the base of the site was always below water level, more so as the work proceeded, since the level rose during the course of the excavation (Piggott 1953, p 136).

More than three hundred upright posts and piles and substantial arrays of horizontal beams at Milton Loch represented the plan and floor layout of a prehistoric house (figs. 11-14). Two boulder areas outlined by piles represented the remains of breakwaters enclosing a harbour. The area they covered was as large as that covered by the house and platform (Piggott 1953, fig. 2) and may therefore be considered an important element of the site. Clear evidence of a timber gangway leading from the shore to the dwelling place gave an alternative to canoes or boats for access.

Few finds came from Milton Loch Crannog but those that did were instructive, and in one case misleading. A fragment of a quernstone in conjunction with cereal and weeds of cultivation pollen are enough to show that arable farming was being practised but more vivid was the discovery of the ard-head and stilt of an early ard (pl. 2. Piggott 1953, 143).

The construction of the crannog was dated to the second century AD according to the discovery of a bronze loop dress-fastener with Pannonian features and a presumably Roman auxiliary origin. About fifteen years after the excavation a

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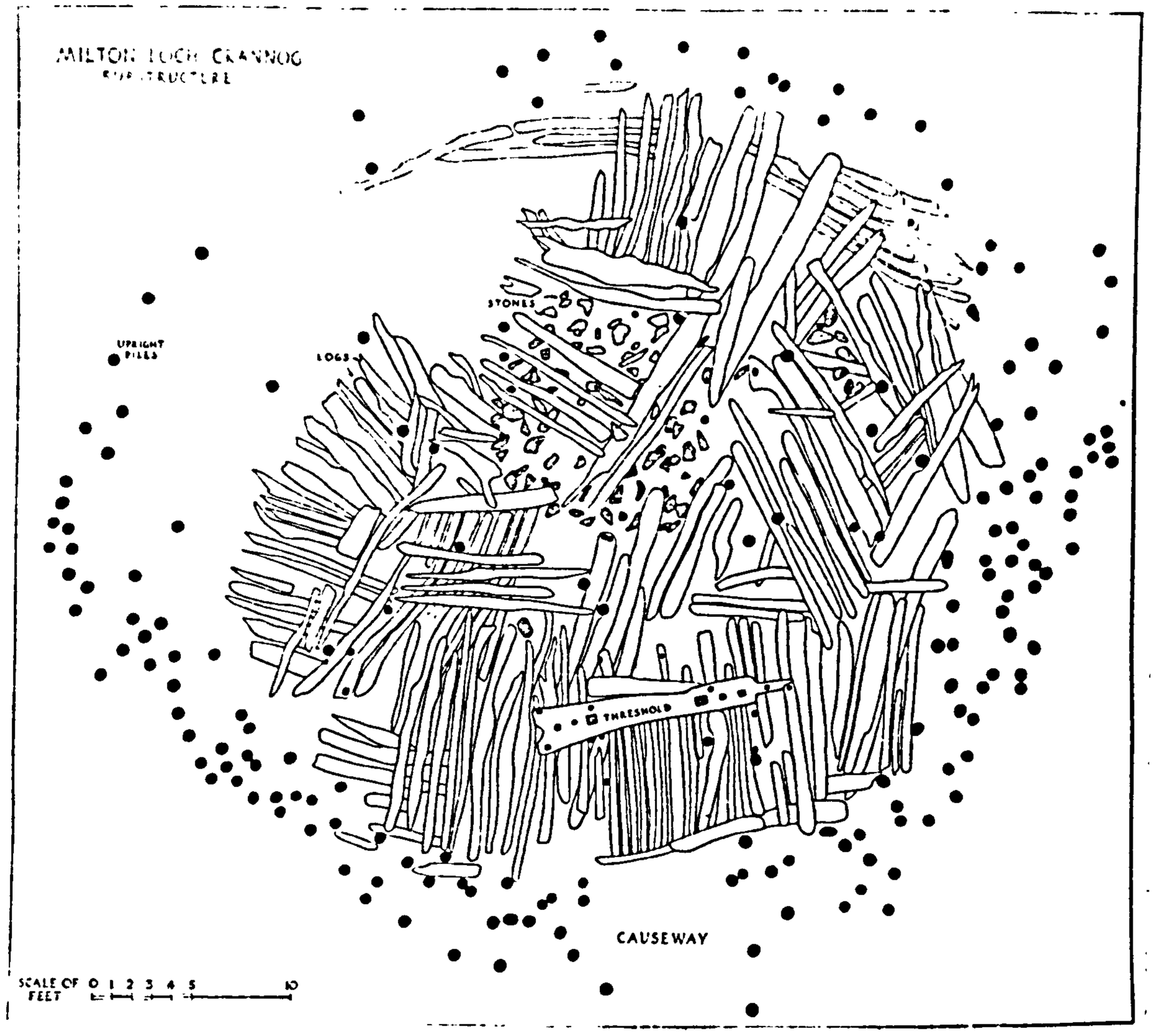

MILTON LOCH CRANNOG
SUPERSTRUCTURE
UPRIGHT PILES
LOGS
STONES
THRESHOLD
CAUSEWAY
SCALE OF FEET 0 1 2 3 4 5 10

Fig. 11

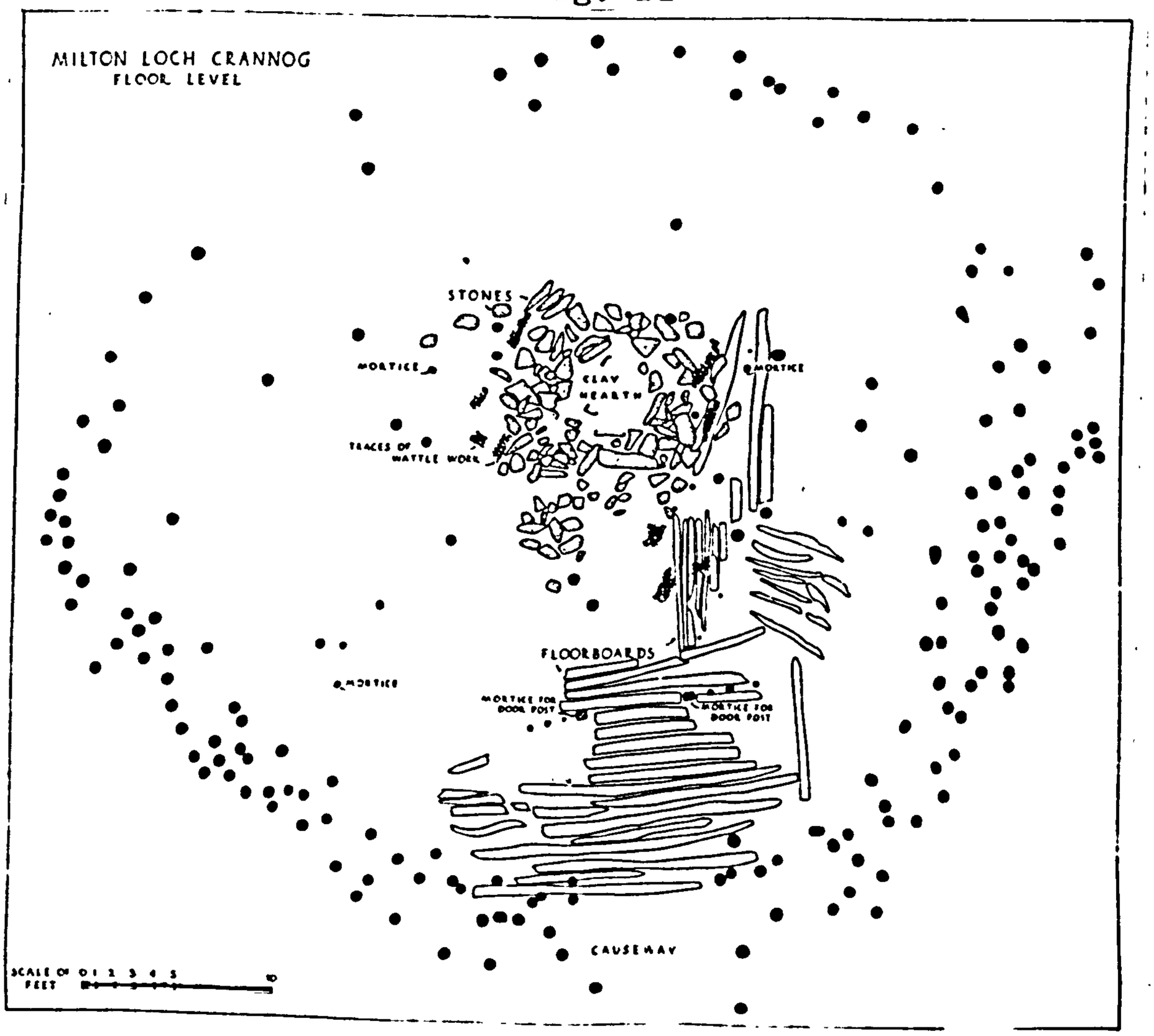

MILTON LOCH CRANNOG
FLOOR LEVEL
STONES
MORTICE
CLAY HEARTH
TRACES OF WATTLE WORK
FLOORBOARDS
MORTICE FOR DOOR POST
CAUSEWAY
SCALE OF FEET 0 1 2 3 4 5 10

Fig. 12

radiocarbon date of 400+100 bc (K-1394. Lerche 1969) was obtained for the ard parts. It was considered too early because such sophisticated ploughs were not at that time considered relevant to a second century AD date, much less to a period some seven hundred years earlier. However, another timber sample from the site was dated in 1973 and supplied a date closely similar to that from the ard (490+100 bc K-2027. Guido 1974, 54.).

This discovery significantly altered the conclusions reached by C M Piggott in the 1953 report. The site must have at least two phases of occupation with construction in the Early Iron Age. Ards were being used from that period, several hundred years before the normally accepted beginnings of such implements in that part of Scotland.

4.6 Loch Glashan, Argyllshire.

In April 1960 the waters of Loch Glashan, Argyll were lowered by 4m in the course of work on a hydro-electric scheme. Some 3m below the former water level close to a small natural island in the southeast of the loch, lay the remains of a crannog. The exposed areas of the site were excavated by Mr J.G.Scott of Glasgow Art Gallery and Museum reported in Discovery and Excavation, 1960 (DES 1960, 8-9). The depth of water over the site suggested that the water level had risen considerably after abandonment. It was an oval, stone- covered mound 17m by

11m prior to excavation but removal of the stones exposed a substantially timber structure.

Observation suggested that the foundations of the crannog were brushwood lying on the mud of the loch bed, in some cases overlain with oak or silver birch logs. Some piles were seen at the edge of the crannog furthest from the shore but there is no record of the number. The Discovery and Excavation report states: "The stones proved to be a thin scatter, except in the northwest sector, where they were some 3 feet deep, perhaps marking the site of a round hut, about 12 feet in diameter. This building appeared to be later than a rectangular structure, about 25 feet by 15 feet in size, defined by a series of massive, parallel oak timbers, their tops in some cases flattened, suggesting the floor of a house" (D & E. 1960, 8-9). It is possible that the 'rectangular structure' was the remains of the flooring of a rectangular or circular house in the form of a 'platform' as demonstrated in other crannog excavations (Milton Loch, Buston, etc.). The 'flattened tops' of some of the floor timbers may have been caused by water erosion rather than deliberate attempts by the crannog dwellers to produce a flat floor. The same effect is seen at Oakbank Crannog, Loch Tay (see F17, App. B).

Organic finds from Loch Glashan were represented by well-preserved wooden objects: 'A trough, four trough-like bowls, a paddle, a scoop, several worked timbers of a structural kind and numerous pegs and pins'. There were also remains of a number of

leather objects '...including parts of sheaths, shoes, and of a jerkin'. Evidence of crop cultivation may be postulated by the discovery of twenty quernstones on the site. A bronze pennanular brooch and Dark Age E ware pottery, suggest a date in the seventh to ninth centuries AD for at least part of the occupation of the site but, recalling the case of Milton Loch Crannog, original construction may have been substantially earlier. The excavator recorded: 'There were some indications of the posts of an older structure lying beneath the other two, but, since this was below the water level at the time, it could not be investigated'.

4.7 Later Surveys.

Since 1960 occasional notices of crannogs have been included in field surveys (for example C & S 1964, 61). Other work included a final year dissertation by a student of Edinburgh University, outlining the Scottish evidence (Savory 1971) and a more extensive thesis submitted for an M. Phil. degree in Archaeology by G. Oakley at Newcastle University in 1973 (Oakley 1973). The latter work is a good summary of the past work and includes a comprehensive bibliography and site gazetteer. In 1973 archaeologists from Edinburgh University in conjunction with a team of Naval Air Command Sub-Aqua Club divers carried out a survey of Loch Awe to establish the number and form of artificial islands in the loch. Possible sites were noted from aerial photographs, ordnance survey maps and old references prior to the

fieldwork and twenty were eventually confirmed. This survey will be examined in more detail in Chapter 9.

Chapter Five

Problems and Prospects.

5.1 Introduction.

Chapters Three and Four show that a great deal of work was carried out in the past on the subject of Scottish crannogs particularly in the second half of the nineteenth century and the first two decades of the twentieth. Many general surveys and observations are recorded in the south-west of the country by, for instance, John Stuart (1865), the Rev. G. Wilson (1873, 1875) and Robert Munro (1880, 1882b, 1884, 1885, 1893) while Blundell (1908, 1909, 1910, 1913) and Hugh Fraser (1915, 1917) examined sites in the highland area. Excavations were carried out, mainly by Robert Munro (1882a), in the last century and occasionally, by a number of excavators, throughout this century, when the opportunity arose (Fraser 1917; Monteith 1937; Ritchie 1942; Piggott 1953; Scott 1960). It might have been expected that such a large effort would have produced a range of comprehensive statements applicable to the construction techniques and structure of the sites and the economy, industrial activities and way of life of their inhabitants but in fact the

great majority of records are merely descriptive and add little in terms of cultural insight into the crannogs or their inhabitants.

Robert Munro was the only archaeologist who attempted to consider crannogs with any profundity and even in 1882 he expressed doubt that the time was right:

> "Notwithstanding the variety and number of objects found in these remains, and the copiousness of details with which the investigations are described, it may still be doubted whether the time has arrived for applying to them the rigid principles of induction, with the view of materially enlarging our knowledge of the early inhabitants of this country" (Munro 1882, 240).

His decision to go ahead and make certain inferences was tempered by reservations with regard to his own lack of experience and archaeological abilities:

> "In attempting, therefore, to deal with the scientific aspect of these discoveries, I do not for a moment profess such a minute acquaintance with the science of archaeology as to entitle me even to attempt a full exposition of the inferences that may be derived from their careful study and comparison with other antiquarian remains;..." (Munro 1882, 241).

He saw no distinction between the utilisation of natural islands where available and both stone and timber crannogs and thought it reasonable to infer that artificial islands were only resorted to where natural ones were absent. He saw no evidence to suggest that the three types were not contemporary, neither did he see wood as a necessary structural component but thought that stone crannogs were more likely to be found in larger lochs with a firm gravel bed while timber was essential as a foundation material on muddy bottoms (Munro 1882, 242). He inferred that stone buildings had greater advantages than wooden ones and that they were a natural progression from the crannogs, culminating in moated mediaeval castles (Munro 1882, 243).

The distribution of crannogs, according to Munro, was restricted to the 'districts formerly occupied by Celtic races' (Munro 1882, 248) with the majority in the south-west and fewer to the north in the area of the Picts and the Scots. He made the ambiguous statement:

> "Nor is this generalisation much affected by an extension of the list, so as to include those stony islets so frequently met with in the Highland lakes" (Munro 1882, 249).

These 'stony islets' he had earlier described as '...mere shapeless cairns, without any indications of having been formerly inhabited' but he does not suggest an alternative function for them. In fact they may in many cases have been similar in structure and function to his classic crannog-type from the

south-west at least in their original form while their inclusion in the archaeological record does indeed make a significant difference to the overall distribution of artificial islands (see below Chapter 8). Munro's assertion that 'proper' crannogs were concentrated in the south-west became so well accepted that it has lasted until the present time (e.g. Cunliffe 1978, 227-228).

With regard to the structure of crannogs, Munro reiterated the sequence noted by earlier observers of brushwood and logs overlain by stones and earth surrounded by one or more rows of piles (Munro 1882, 259). With reference to his excavations of Buston, Lochlee and Lochspouts crannogs in Ayrshire (see above) he praised the skills of the crannog builders:

> "...all the wooden islands were constructed after one uniform plan, this plan was actually the outcome of the highest mechanical principles that the circumstances could admit of" (Munro 1882, 261).

and he formulated a more detailed description of the method of construction consisting of six major elements (Munro 1882, 262-263).

His theory was that a circular raft of logs was positioned above a foundation deposit of branches and brushwood and was then covered with more timbers as well as stones and gravel until the mass rested on the loch bed. Ready-cut oak piles were then inserted through holes in the structure 'and probably also a few were inserted into the bed of the lake' (Munro 1882, 262). The

logs in the raft were occasionaly pinned together by thick oak pegs and the uprights were fixed with mortised oak beams while other beams were mortised together to give lateral strength at various levels. When the mass of material extended above the water level the oak piles which surrounded it were joined with more mortised beams and a 'prepared pavement of oak-beams was constructed'. Munro added: 'The margin of the island was also slantingly shaped by an intricate arrangement of beams and stones,...' (Munro 1882, 262) producing a well-formed breakwater. He suggested that turfs were laid over the protruding points of piles and that '...a superficial barrier of hurdles, or some such fence,...' was erected close to the edge. He also postulated the frequent erection of a submerged wooden gangway giving secret access to the site. Because of the lack of evidence for superstructure elements he made no mention of the type of dwelling or shelters which may have surmounted the pavement.

The inhabitants of the crannogs were, according to Munro, ultimately descended from European Celts who had constructed the lake dwellings in Switzerland and elsewhere on the Continent. These people had migrated to Britain, because of pressure and conflict in their own lands which resulted in the abandonment of the lake dwellings there, and had been driven to the far north and west by 'successive waves of immigrants' (Munro 1882, 287). Their occupation of the crannogs coincided with the Roman presence in the south-west of Scotland and the crannogs were built as a response to the times when the Romans withdrew and

left the provincial population to the mercies of their less civilised neighbours to the north (Munro 1882, 464). The close connection which Munro proposed between the crannog builders of Scotland and the lake dwellers of Switzerland was based mainly on the similarities of the two types of site and he was not in a position at the time of his researches to know that there were in fact few points of comparison either chronologically or structurally between the two.

He proposed three reasons for the submergence of crannogs (Munro 1882, 272); compaction of the structural material of the site, sinking into soft bottom muds or general compression and sinking of the loch-bed sediments; and suggested that the latter process was the most evident. He did not see water level changes as significant. His conclusions were derived from the results of the excavations which he carried out in the south-west and no-one before or after has produced alternative hypotheses. However, work in Loch Tay (see Chapter Ten) shows that the reasons for submergence of sites there are not in accordance with Munro's statements.

The conclusions arrived at by Munro in Ancient Scottish Lake Dwellings have been covered here in some depth since they represent even now the core of crannog thinking. Although he stated his reservations before making inferences at that time he did not significantly alter his views in his later work.

In 1886 he published a paper in the Journal of the Anthropological Institute entitled 'The Archaeological Importance of Ancient British Lake-Dwellings and their relation to Analogous Remains in Europe'. The opening sentence read:

> "It appears to me that the time has now arrived when an effort should be made to interpret the historical value of the antiquities recovered from the sites of ancient lake dwellings, now so numerously discovered and recorded in this country" (Munro 1886, 453).

In the paper he reiterated his earlier points with regard to the location and structure of crannogs and the origins of their inhabitants and he went on to say,

> "The great value, however, of the investigations of the lake dwellings in the south-west of Scotland depends on the quantity and variety of the remains of human industry discovered in and around their sites."
> (Munro 1886, 459).

He states that it is from the finds that "archaeologists attempt to reconstruct the outlines of the social life and organisation of the prehistoric past" (Munro 1886, 459), and goes on to describe the wide range of finds from the sites he excavated in the south-west. The large number of Roman objects shows him that they were in contact with the lake-dwellers but he also points out that the native Celtic element is 'strongly developed'. The similarity with Irish material on similar sites reinforced the Celtic elements for him.

He made a number of inferences, based mainly on the evidence of finds, which are essentially correct. He saw crannogs as a native Celtic development owing nothing to Roman or later Saxon influence although there was clearly contact with the Romans and possibly with the Saxons. Similarities with sites in Ireland supported a Celtic or native origin. The mass of accumulated debris over the wooden pavements, the size and contents of the middens and the superimposed hearths suggested prolonged but occasionally interrupted occupancy and the range of tools and implements as opposed to weapons showed that the inhabitants were not thieves and robbers, or soldiers but peaceful farmers carrying out a role as defenders not conquerors. He was of the opinion that crannogs probably did not exist in the south-east of Scotland because there were no suitable lochs and that canoes did not necessarily indicate the existence of crannogs, as Stuart had suggested in 1865, since they were associated as often with mediaeval sites.

However, Munro also re-emphasised his contentions of 1882 that the crannog builders were ultimately descended from the Swiss lake-dwellers, that they had arrived in south-west Scotland and Ireland via the south of Britain and that their occupation of the crannogs was tied closely in time and space to the Roman presence. He reiterated more firmly the 'exact resemblance' between the crannogs and the fascine dwellings of Switzerland and, since he was under the impression that many of the Swiss sites belonged to the Iron Age, implied that they were

contemporary. According to Dr. Ruoff of Zurich (see below) there are no sites similar to crannogs as far as he knows in Switzerland and only the sites of Zug in Switzerland and Oakbank crannog in Loch Tay are possibly contemporary, with dates that may fall in the eighth century BC (Ruoff 1980, 154. App. H).

In fact Munro did not satisfactorily reconstruct the outlines of the social life and organisation of the prehistoric past, probably because he had not carried out any more large-scale excavation in Scotland and instead had broadened his interest to cover lake-dwellings throughout Europe. This resulted in publication of 'The Lake Dwellings of Europe' in 1890 which was the text of the Rhind Lectures for 1888 (Munro 1890).

The high standard of Munro's work for his day is demonstrated by its endurance to the present time and contrasts with the lack of lasting impact of the subject itself. Crannogs are usually treated in a cursory manner by archaeological writers but where they are referred to it is in the terms laid out by him. His structural sequence has not been superseded and the concentration of distribution in the south-west of Scotland is still accepted. Although archaeological evidence does not now support the notion of crannog-builders originating from the Continental lake-dwellers no other hypothesis has yet replaced Munro's, and although they are no longer restricted chronologically to the post-Roman period, as stated by Munro, the earlier dates now available have not yet become firmly fixed in the archaeological record. Munro's ideas are so firmly

established that they can only be replaced by systematic studies carried out in a chronological and cultural framework not available to him.

5.2 Results of twentieth-century excavations

Potentially a number of the sites excavated during the twentieth century had a great deal to offer. The island in the Loch of Kinellan covers half an acre and according to the results of excavation in 1915 (see Chapter Four) was constructed in the same manner as the crannogs in the south-west with a timber framework and a substantial build-up of organic debris, large worked and unworked timbers, layers of peat of different sorts, mortise joints and hearths. These and the rémains of habitation debris in the form of parched barley, ash, bones, hazelnuts and leaves point to large amounts of structural and cultural evidence. That it was a multi-phase site is indicated by a layer showing evidence of abandonment between upper and lower occupation phases. In the upper part of the site was apparently mediaeval in date according to finds of glazed pottery in abundance but 'small pieces of fired clay' and 'fragments of pottery' (Fraser 1915, 250) at the base of one of the pits c. 3m below the surface may indicate daub and less well made pottery of an earlier type.

Nineteen pits were dug in all (Fraser 1915, 237) as it was not possible to cut large trenches due to the ingress of water and even the pits were affected by this problem. He referred to the difficulties of encroaching water eight times in his paper to the Inverness Scientific Society (Fraser 1915) and recounted the efforts which he made to combat them. The pits were made deliberately small and in some cases where pits were enlarged the part which had already been examined was backfilled so that there was less area through which water could percolate. Fraser constructed a home-made water pump from bicycle tyre inner tube and tin cans to try and keep the excavations clear but with little success (Fraser 1915, 243) and had to abandon the early trenches (Fraser 1915, 237).

The potential of the site was not realised mainly as a result of the excavation strategy dictated by the water problem. No site plan was produced although all nineteen pits showed clear evidence of many timber features. It was not even possible to establish how many houses the island had supported or whether they were circular or rectangular. The lack of analysis of the mass of environmental material and the impossibility of dating the site except from the finds meant that little could be said about the people who lived there in the early periods.

The crannog in Lochend Loch, Lanarkshire, excavated in 1932 and reported by James Monteith was also a large site 40m x 30m (Monteith 1937). The potential for useful information about the structure and the inhabitants was high as a floor area was uncovered with uprights still set into mortises in the horizontal timbers (Monteith 1937, figure p. 33). At least two floor levels were excavated and coarse pottery suggests that the early phases may have been of prehistoric date. The description of a small vessel sounds like a crucible (Monteith 1937, 38). Many pieces of worked wood may be in some cases the remains of furniture (Monteith 1937, 37) and a wooden post base in a circle of beams surrounding a stone floor was possibly the pivot for a door (Monteith 1937, 35). Cattle teeth and hazel-nuts are the only evidence of foodstuffs and the excavator suggested that the hazelnuts may have been ground on a rotary quern the remains of which were discovered. The dwelling was apparently burnt down and the remains of a calcined human skeleton were found in the area of the inside floor while another was uncovered outside.

The loch was drained prior to excavation but most of the work was carried out in very muddy conditions and a commercial water pump was used to keep the site dry. The mud or 'peat soup' was shovelled into barrows by workmen then taken along slippery planks to the shore. As in the Loch of Kinellan the pump was continually clogged by peat and wood but Monteith recorded, "I may say that we could not have worked in this area at all had we not had the use of the petrol pump..." (Monteith 1937, 28). The

'peat' overlying the floors was treated as spoil. There is no evidence in the report that it was considered as habitation debris and it was not analysed. The site was only partially excavated since the local council who owned the loch wanted to refill it.

The crannog in Loch Treig which was excavated in 1933 is known by written references to have been used in the post-mediaeval period. Excavation was carried out in the usual method by a team of workmen under the supervision of an archaeologist. Although a lengthy report was produced (Ritchie 1942) it dealt almost exclusively with a detailed description and reconstruction of the timber structure to a level which could hardly be justified by the extent of the excavation. Pits were opened in the top of the mound and sections were cut near the outside edges but it appears from the plates in the excavator's report that a clear and concise outline of the structure as portrayed in the record could not have been realised.

One discrepancy in the report was observed during a visit to the site in 1983 as the crannog was exposed by the low level of the loch. A ridge of material with substantial longitudinal timbers suggested evidence consistent with a gangway to the shore though Ritchie stated that he had observed no such timbers though he cut trenches along and across the ridge (Ritchie 1942, 46). He reconstructed the dwelling as a rectangular house on a similar substructure (fig. 10) but the mound as it stands is almost

circular. He inferred that the upper platform had been constructed in such a way as to be always submerged and outlined an ingenious method by which the builders lowered the level of the loch so that they could construct the island in dry conditions (Ritchie 1942, 50).

The site was dated to the sixteenth century by finds but the depths of organic debris and the layers observed during excavation (Ritchie 1942, 48) may suggest a number of phases of rebuilding over a lengthy period of time. The layers of peat and heather were construed as building materials and were apparently not examined for evidence of habitation.

Milton Loch Crannog I (Piggott 1953) is the closest that work on a crannog comes to the standards required of modern excavation. It is notable that there was no overburden of large boulders and above the wooden floor were 'small weathered stones and plant roots' (Piggott 1953, 136). The excavator makes no comment about the layer of humic material which is clearly seen in one of the site photographs (Piggott 1953, Plate XI, 2) and this may be partly the remains of habitation debris which had built-up during occupation of the site. The floorboards beneath this overburden were flat on top but rounded on the bottom (Piggott 1953, 137) like those seen at Oakbank crannog in Loch Tay (see Chapter Ten) and were probably the subject of considerable erosion on top rather than deliberate cutting. This would suggest either that the site had been abandoned for a length of time with these timbers exposed and was then reoccupied

or that the floor was in use long enough for this erosion to have taken place.

The upper area of the crannog was almost all exposed during excavation and a plan of the horizontal timbers and piles allowed the excavator to produce an outline plan and reconstruction of the house and surrounding walkway (fig. 14) with a reasonable level of confidence. She was of the opinion that only one phase of construction was represented but the bronze loop-fastener dating to the second century AD (Piggot 1953, 144) and the ard-stilt dated to the fifth century BC (Guido 1974, 54) show at least two periods of occupation so far apart in time that some reconstruction must have taken place in the later phase. The massive number of piles surrounding the island were randomly distributed according to Piggott (1953, 143) but this is unlikely and the apparently haphazard arrangement is likely to be a result of the different phases of building and strengthening represented by the uprights. The same problem was encountered at Oakbank (see Chapter Ten) and can be overcome by dendrochronological analysis, total excavation and close observation and recording.

For the first time in a crannog excavation seeds from a recognisably functional feature, the hearth, were examined and a sample of peat was analysed for pollen. Polygonum was well represented both in the peat and from the hearth and is a plant not only found in conjunction with cereal but gathered in its own right as a food source (Renfrew 1973, 183). Grass and a wide variety of herbaceous pollens were recognised, many of them weeds

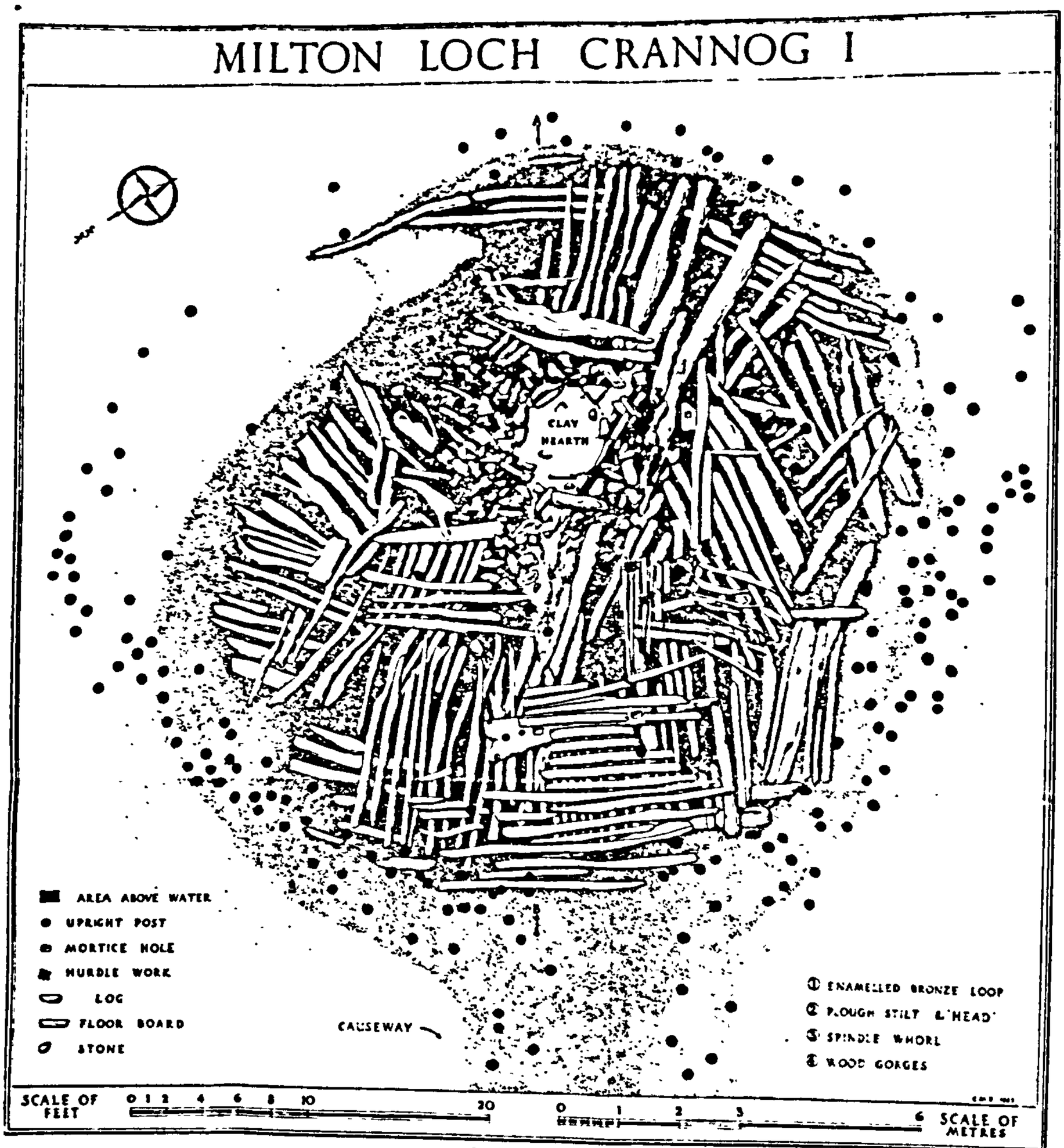
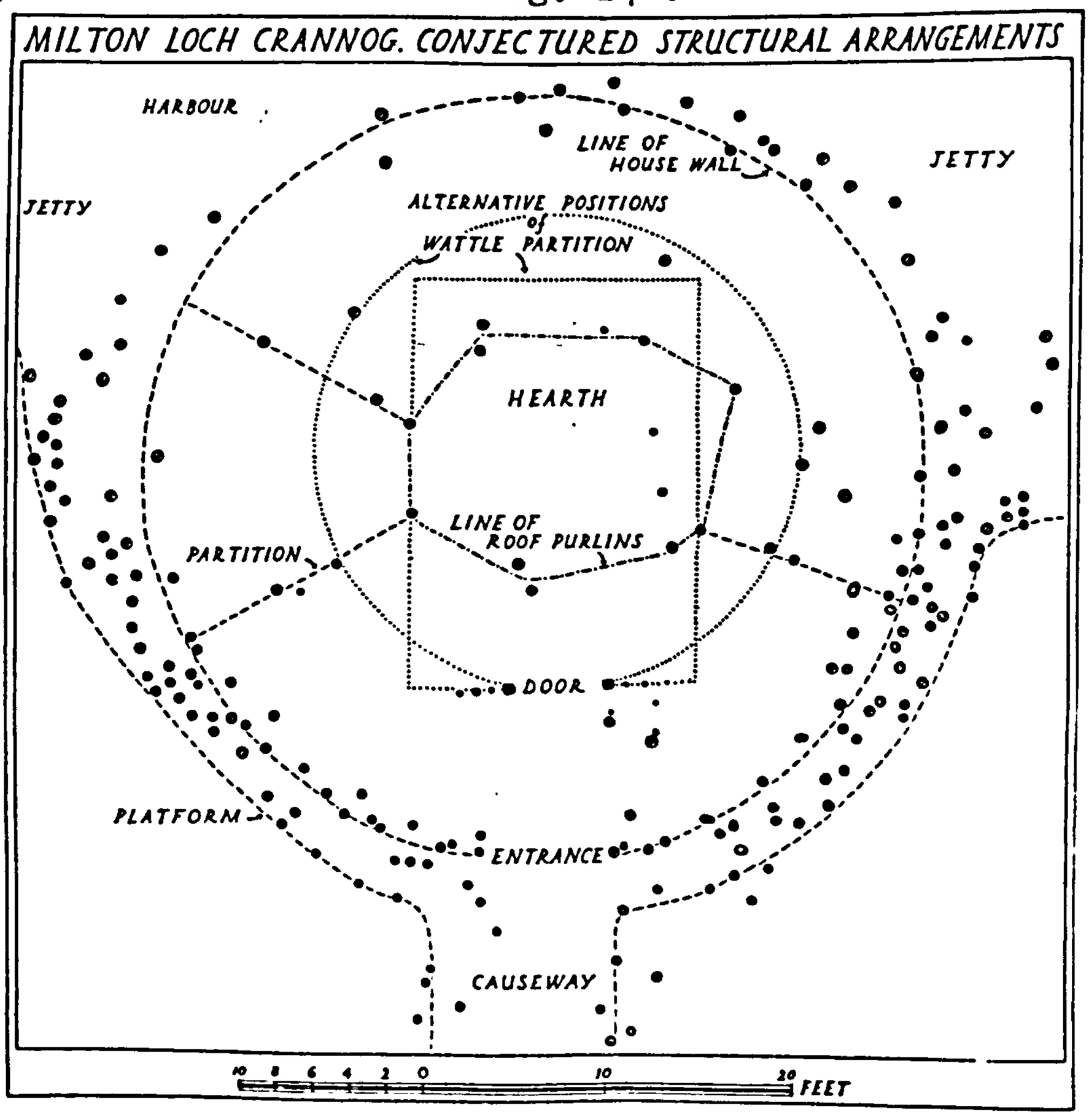

MILTON LOCH CRANNOG I
CLAY HEARTH
AREA ABOVE WATER
UPRIGHT POST
MORTICE HOLE
HURDLE WORK
LOG
FLOOR BOARD
STONE
CAUSEWAY
ENAMELLED BRONZE LOOP
PLOUGH STILT & 'HEAD'
SPINDLE WHORL
WOOD GORGES
SCALE OF FEET
0 1 2 4 6 8 10 20
0 1 2 3 6
SCALE OF METRES

Fig. 13

Fig. 14


MILTON LOCH CRANNOG. CONJECTURED STRUCTURAL ARRANGEMENTS
HARBOUR
LINE OF HOUSE WALL
JETTY
JETTY
ALTERNATIVE POSITIONS of WATTLE PARTITION
HEARTH
LINE OF ROOF PURLINS
PARTITION
DOOR
PLATFORM
ENTRANCE
CAUSEWAY
10 8 6 4 2 0 10 20 FEET

of cultivation (Piggot 1953, Appendix I, II). Cereal pollen was also discovered and with the ard-stilt and a rotary quernstone shows good evidence for arable farming.

Similar types of pollen and seeds and an ard from Oakbank crannog indicate an economy in essence the same as at Milton Loch (see below Chapter 11). In fact, although the latter is slightly smaller overall than Oakbank crannog, the two sites are similar in a number of ways. Both have the remains of pile-supported gangways to the shore and remains of either a jetty or harbour, timber floor layers of complete trunks eroded on the top, clear evidence of arable agriculture including remains of ards, and a mass of surrounding piles representing more than one phase of occupation. Phases of both sites are seen to be contemporary by radiocarbon dating (App. H). Piggott was of the opinion that highland and lowland crannogs were 'basically different' and that the latter supported more permanent habitation Piggott 1953, 147). She also thought the lowland sites were on the whole earlier although she said it was not possible to claim a difference in date between the two groups (Piggott 1953, 148).

The upper foundation layers immediately underneath the floor were exposed (fig. 12) but the lower foundation structure was below the water and it was not possible to examine it or establish whether lower floors existed. The excavator stated in the report that the ard was 'almost certainly deposited deliberately beneath the house foundations as a ritual offering to the gods...' (Piggott 1953, 144) presumably under the

impression that there was only one floor and that the ard could not have been deposited beneath it in any other way. Doubt must be introduced to this theory given the date of the ard and the fact that the Pannonion loop-fastener was found on the floor but it is notable that the Oakbank ard was also directly beneath the upper floor there. This does not necessarily imply support for a theory of ritual deposition since presumably wooden ards would not be of great value and therefore removed upon abandonment of a site and would be left lying on the top of the habitation debris build-up to be directly overlain by subsequent floors.

In 1960 during work by the Hydro-Electric Board in Loch Glashan, Argyll the loch level was lowered and the remains of a crannog were exposed. It was 35m x 16m and two living floors were exposed (Scott 1960) reputedly supporting a rectangular house 6 m wide overlying a smaller circular dwelling. A number of well-preserved wooden domestic utensils were discovered including bowls, troughs, spoons, barrels, a 1.5 m long paddle and a finely-made scoop. Leather articles were well represented with boots or shoes and remains of a jerkin. Apparently there was no evidence of food refuse though cereal cultivation may be indicated by the presence of more than twenty querns. Pottery assigned a date around the sixth century AD for the upper floors but the excavator recorded observing earlier floors beneath the water that surrounded the site (Scott 1960, 8-9; Glasgow Herald 11-8-60, 7). Obviously he could not excavate them in that position.

5.3 Inadequacies of past work

Neither Munro and his contemporaries nor the later excavators produced the level of interpretation of either the structure of artificial islands and the dwellings upon them or the way of life of their inhabitants that would be expected now considering the wealth of well-preserved organic material that was uncovered. This is not a reflection upon the skill of the archaeologists who, given the constraints which applied when they were working, carried out their excavations to an acceptable standard and in the case of Munro to a higher standard than was normal for the time.

His structural sequence was so convincing that it has been accepted apparently without question to the present. However, a number of points are not clear. For instance, how would the layers of brushwood, earth or peat be deposited effectively underwater since the brushwood would float and earth would dissipate or change into mud if dropped into any reasonable depth of water. Peat could only be laid in cut blocks but there is no evidence according to excavation reports for peat in that form. It may reasonably be argued that these deposits were built-up in a less systematic manner probably above water as floor covering and evidence presented below from Oakbank crannog (see Chapter Ten and App. E) supports this theory.

Munro did not explain why the sites were not built as free-standing pile dwellings since he demonstrated in his excavations, of Buston and Lochlee crannogs in particular, that the walkways surrounding the sites were skilfully constructed of jointed piles and beams in this way. In fact, Munro seems to have been the only archaeologist to ask why the crannog builders gave 'a preference to the fascine structures' (Munro 1886, 469) and he gave the answer that the bases of the lochs were too soft and yielding to support true pile dwellings. If this was the case then the same reason would prevent the well-mortised pile construction of the surrounding platforms. None of the twentieth-century excavators was in a position to challenge Munro's sequence since in no case did they carry out complete excavation, usually because the bottom of the site was still underwater or was heavily waterlogged.

Most of the past work on crannogs emphasised the structural elements of the island itself, understandably, since most of it would have been permanently underwater and therefore better preserved than the actual house which was always intended to be above the surface. However, features of the dwelling were preserved and have been recognised in most of the excavations. Log pavements or platforms usually constructed of small unworked tree-trunks were common and were often associated with one or more hearths. Some of the piles surrounding the site and other timbers nearer the centre probably represented remains of the house outside walls, supports for the roof and internal

partitions.

Munro said nothing about the form of the houses that stood on the crannogs which he excavated. Reconstructions were attempted by Professor Ritchie with regard to the crannog in Loch Treig (Ritchie 1932, Plate XIX) and Mrs. Piggott for Milton Loch crannog (Piggott 1953, fig 5). The first of these was highly speculative as it was based on evidence mainly from the substructure which was itself conjectural and was not completely uncovered. The Milton Loch house is also speculative but at least the upper layers were uncovered and the plan is based on observed uprights and floor timbers.

There is no record of efforts by past workers to delineate the area of the house and the boundaries of specific activity areas and it would be more difficult to do so if the material overlying the floors was treated as spoil, which it usually was, since it may have contained debris indicative of industrial and domestic functions. The number of hearths was often recorded and their vertical distribution was also occasionally noted but there is seldom an accurate record of their association with other features and with each other.

The dates assigned to crannogs in the days prior to the development of radiocarbon or dendrochronological techniques were based on the evidence of finds and in most cases fell between the time of the Roman occupation and the mediaeval period. Munro was adamant in his assertion that no crannog, which had been

examined, was earlier than the Roman Iron Age (Munro 1886, 465). Piggott was of the opinion that Milton Loch Crannog was built and inhabited in the second century AD but was proved to be several hundred years too late by radiocarbon dates (Piggott 1953, 147; Guido 1974, 54). It is reasonable to accept the dates based on finds assigned by early researchers as relating to phases of occupation, at which time the particular find was deposited, but many sites may have been occupied a number of times and the first structural phase cannot be assigned by finds unless they are unambiguously associated with that phase. It is notable that every radiocarbon date from a crannog so far falls in the first millenium BC and one, from Oakbank crannog, is possibly as early as the eighth century (App. H).

It can be seen from the summary of past results that emphasis was placed on study of the structural timbers, mainly from foundation layers, and surrounding piles and stakes. Where the lower foundation deposits were underwater greater emphasis was placed on upper foundation layers and the remains of floors. Very little was said about the crannog builders and dwellers or about the details of houses and internal features even though a mass of data was lying on and under the floors in the form of organic debris. It will be shown in the report and summary of the excavations being carried out on Oakbank crannog, Loch Tay in Chapters 12 and 13 of this thesis that these and broader aspects of crannog work can be successfully studied through excavation, analysis and interpretation using modern methods and techniques which were not available to the early archaeologists.

5.4 The problems of past excavations

One of the main problems with early crannog research was the method of excavation. Usually a gang of workmen was employed to shovel the spoil from the site into barrows and dump it on nearby spoil-heaps. The work was supervised and observed by the archaeologist who would make sketches of what he considered were important features. If he was not on site at all times he would examine the spoil heaps and any finds that the workmen had picked up upon his return. This method of working would have serious consequences for the number and range of finds discovered but more importantly the context and association of finds and features would in many, if not most, cases be lost.

The inadequacy of such methods would be particularly severe on a crannog where many of the features are constructed of soft timbers which can easily be cut through with a spade. An imbalance would be created in the types of wood recognised in structures since oak would not be cut or broken while other types would be easily destroyed. Robert Munro was one of the most conscientious excavators in the nineteenth century and records sieving the spoil from Buston crannog (Munro 1882, 204) but this was obviously not wholly effective as he discusses elsewhere cases where finds were discovered later having been removed from the site during the excavation. An ancient forgery of a Saxon coin was found in material removed from the site by a local schoolteacher (Munro 1882, 230). It was brought to the attention

of Munro, but many other finds must have been dispersed without record such as a number of objects 'publicly exhibited at a bazaar in Kilmarnock' (Munro 1882, 236).

Another aspect of the early methods of excavation which would inhibit efficient study was the habit of digging pits into the top of the site or opening small trenches. The problem was already been discussed in relation to the excavations at the Loch of Kinellan (see above). This practice in conjunction with the problem of using untrained workmen must make the results from many of the early sites of dubious worth.

Accurate recording of features in the form of measured plans and sections was not carried out on many sites and even where it was the results were often at a scale too small to be of much use. Not only does this mean that there were few plans for future research and comparison but with the complex arrangements of timbers and layers on a crannog the excavator would not be able to retain them all in his memory and site interpretation must have suffered. Usually only areas which seemed to be of particular structural interest to the excavator were sketched so that records of the site are highly subjective. This same problem of subjectivity was practised with regard to finds in that attractive artifacts were collected for museum or personal display but the many unassuming wooden objects which must have been uncovered on crannogs are hardly mentioned.

5.5 Disadvantages of drained sites.

The single major problem which has done most to prevent the systematic study of crannogs and has caused the greatest difficulties with the work that has been carried out is that of waterlogging. Crannogs by definition are built in water and their remains are still in, or in many cases under, water. Although some efforts have been made to examine sites which are still islands the difficulties which these endeavours encountered are demonstrated by the work carried out in the Loch of Kinellan (see above). Even sites which were substantially drained but where the lower layers were still submerged, as in the cases of Milton Loch crannog and the site in Loch Glashan, could not be excavated completely.

Total drainage has usually been accepted as the best method, until recently the only method, of approaching excavation of an artificial island. However, working on a drained site is very much a compromise as there are many problems associated with drainage. The cost of damming a site is very expensive and would probably not be seen as justifiable for archaeological research. To consider damming a number of crannogs which would be required for systematic studies would be prohibitive.

In past work the sites have been drained for other purposes, mainly agricultural in the nineteenth century and hydro-electric power schemes in the twentieth. The later excavations have often been restricted in time by the necessity to reflood the loch and could not guarantee a fully drained site. Furthermore, since there was no question of choice of site the work could not be systematic or prepared for. Even sites which were totally drained, such as Lochlee which had been dry for forty years before Munro excavated it, were in areas with a high water table and suffered from water leaking into the low levels of the excavation (Munro 1882, 73). Munro's records of the excavations at Lochlee, Buston, Lochspouts, Barhapple and Friar's Carse make up the greater part of his book, Ancient Scottish Lake Dwellings, on which so much has been based. Yet he talks in every case of work being curtailed to one extent or another because of water.

It would be difficult to observe fine or subtle features in the unavoidable muds of a drained but still wet crannog and small finds such as pins and beads would not be easy to see. All of the objects from the excavation would have to be washed clean to establish the degree of working and cut-marks of tools, if any. None of the past excavators record carrying out such a task and it would seem inevitable that a large number of small finds and features were missed.

The decay of organic deposits starts within minutes of exposure, even underwater, as was demonstrated during the excavation of Oakbank crannog (see below). Thus, the effect of draining a site must be the loss of a great deal of archaeologically important material. Damage caused subsequently by wind, rain and sun exacerbates the problem. The deposits which have been drained are thus necessarily in a worse state of decay than if they had remained beneath the water.

Decay is not the only danger to organic objects on a drained site as mechanical damage would have been far greater than when the object was underwater. Thin pieces of wood and material like basketwork would not in their weakened state support their own weight so the chance of successful exposure and removal of many finds would be slight. One of the most severe causes of mechanical damage may be illustrated by the results of a simple experiment. A number of timbers from Oakbank crannog were weighed underwater with a spring balance. The total weight was 1.36 kg. The same timbers weighed out of the water totalled 14 kg., an increase of more than tenfold.

The implications of this may be more fully appreciated by looking at the photographs of Milton Loch crannog during excavation (pl. 3). The considerable numbers of large timbers express a significantly heavy force upon the archaeological features and artifacts underlying them. This force would only be exerted by bringing the mass of timbers above the surface, at

Plate 3a

Plate 3b

which time damage to delicate archaeological material is inevitable.

Another disadvantage of draining a crannog would be the task of removing timbers during excavation, presuming that they were required to be kept in one piece. A number of people would be required to lift and carry the larger timbers across the slippery, muddy surface of the site. Since a timber weighing 20 kg. underwater would weigh 200 kg. in air the potentially disastrous results of a slip by only one of the carriers can be appreciated. Of more concern archaeologically is the effect of trampling upon underlying deposits during such an operation and throughout the work of excavation.

There are other disadvantages of carrying out archaeological excavation of crannogs only when they are fortuitously drained for agricultural purposes or exposed for industrial development. It is possible that a site where continued access relies upon the scheduling of other projects a site may not be available long enough for effective examination or excavation to take place. This was the case during the excavation in Lochend Loch when the local council required the site to be reflooded for use as a boating pond (Monteith 1937, 37).

Crannogs presented in this randomly selected manner may well be in isolated locations, as in the case of Loch Treig, without close association with regional or local groups and although this does not lessen the inherent importance of any site it would be

more useful to choose one which might add to established knowledge than to be forced to study an isolated monument. A serious disadvantage of studying unassociated crannogs is that they will only fit into the existing body of knowledge relating to artificial islands in the same haphazard manner that applied to previous excavations. Given the probable impediments to effective study presented above they are likely to add little more to the archaeological record than those examined in the past.

5.6 Chronology

Absolute methods of dating archaeological sites, like radiocarbon assay and dendrochronological analysis, were not available to crannog excavators prior to the 1960s. Thus, as with other sites, dating was by association of finds which placed crannogs in a range from the Roman Iron Age to the post-mediaeval period. Since many crannogs have apparently been reused a number of times there is no way of dating the primary construction unless the finds were definitely associated with established elements of the original structure. The above difficulties of excavation, observation and recording make it unlikely that such elements were, or could be, established so the finds upon which the loose framework of crannog chronology is based may be from periods of occupation long separated from either the date of construction or other periods of habitation.

A major problem in assimilating the broad range of crannog knowledge into the archaeological record was directly related to the common tradition of examining the record by periods. Since crannogs were dated by artifact association to a number of periods but did not fit neatly into one, they were occasionally briefly mentioned by archaeologists specialising in the study of a specific period but the greatest effort of these researchers was expended upon site types which were confined chronologically within their particular area of research. Crannogs were neglected and there is no corpus of knowledge developed and established in the same manner as that referring to other types of sites.

Efforts do not seem to have been made in the past to construct relative site chronologies with different phases distinguished by archaeologically distinct features and arrangements of timbers. Munro observed superimposed hearths at Lochlee (Munro 1882, 79) and Lochspouts (Munro 1882, 165); Fraser distinguised upper and lower phases on the island in the Loch of Kinellan (Fraser 1915, 260) and many distinct layers (ibid., 249); Scott referred to two separate houses at Loch Glashan and an earlier phase under the water (Scott 1960, 8); but none of them attempted to define chronologically the length of different phases or the overall period of habitation. The problems of excavating on drained or partially drained sites, particularly in terms of detailed observation and recording difficulties, may be major factors to blame for the lack of definition.

5.7 Future research

The main part of this chapter has indicated that although a substantial amount of work has been carried out in the past on the subject of crannogs, with relatively systematic study in the nineteenth century and a number of excavation reports from the twentieth, little of substance has been added to the archaeological record in Scotland. A number of reasons have been put forward for this inadequacy and the rest of the chapter will suggest how the problems inherent in the work of the past may to a great extent be overcome and why the time is appropriate for further research to take place and what form that research should take.

The most important change which has taken place since the early crannog researches is the progressive development in all aspects of archaeology but in particular, for the problems discussed above, in the standards of excavation. Rigorous observation and recording of context, stratification and association has improved quantitatively and qualitatively the information derived from archaeological sites. These developments require little discussion in this thesis as they are documented elsewhere (e.g. Barker 1977).

The problem of dating has been substantially overcome by the invention and adoption of radiocarbon dating and latterly dendrochronological dating. Both of these techniques require amounts of organic material; small amounts of any of a wide range of substances in the case of radiocarbon determinations, and discernible tree rings on substantial timbers in the case of dendrochronology; and both are therefore applicable to the dating of organic and timber-rich sites like many of the crannogs. As noted above the radiocarbon dates available so far from crannogs all fall in the first millenium bc suggesting that sites already excavated may have been constructed earlier than had been supposed (see below).

One of the most potentially productive associations may be that between the examination and analysis of organic debris from crannogs and the wide range of environmental studies which have become established in the last two decades. Seeds, pollen and macro-plant remains are found on many artificial islands and may also include insect remains, eggs, larvae, snails and excreta from a wide range of organisms. Whereas in past work this mass of material was treated much as spoil it may now be used in various ways: to delineate specific working areas; to indicate the range of plants used for food and the types and level of crops cultivated; to suggest climatic variations and to chronicle the evolution of the landscape. Sophisticated and well-considered sampling techniques now available make possible the recognition and interpretation of a wide range of naturally

and artificially deposited materials from crannogs.

5.8 Underwater excavation to overcome the effects of drainage.

The problems of crude methodology, inadequate dating and the lack of effective analysis of organic deposits can now be overcome with modern developments in archaeology. The effects of draining a site and the ensuing problems of working it cannot be overcome in archaeological terms. If drainage on demand is too expensive and inadvisable anyway because of the effects listed above, an acceptable alternative may be to excavate the site underwater in the environment which has already protected it for so long.

The excavation of crannogs underwater if it could be carried out with the benefit of modern excavation techniques and standards of recording would allow important information to be derived scientifically from these sites for the first time. Examination of timbers would allow close dating of the sites and recognition of different phases of habitation, while sampling of other organic deposits could enable accurate studies of climatic changes and the development of the landscape to be conducted. Many of the problems of excavating crannogs on land would not be relevant in an underwater excavation.

A submerged site to be excavated may be chosen with regard to the results of pre-excavation survey. Exposed timbers and organic deposits may be readily sampled and analysed for dating and environmental indications before a stone is moved. Since the work would not be related to the timetables of industrial development or agricultural land use the imposition of working to a deadline would not apply.

The limited information now available from past excavations would no longer be the best that could be expected but the basis of new research and much of the new work would be based upon questions posed by the early researchers. The recent surveys of Loch Awe in 1973 and Loch Tay in 1979 demonstrate that many crannogs are located relatively close to each other (App. A). Where contemporaneity can be proven, as in the case of numbers 3 and 4 in Loch Tay, comparisons and contrasts of the material from these sites would be very important and ambiguous questions on one site may be answered by work carried out on the other.

More practical problems may also be overcome by underwater excavation. The difficulties of observation on a muddy site would not exist as such under water. There would be no restrictions upon the depth of layers of excavation. The basal layers would be as accessible as the upper features and work could also be carried out on the surrounding loch bed where fish traps and canoes may be suspected. The weight of timbers would be of no threat to delicate finds and archaeological features and could be

easily removed with the minimum of disturbance since the worker under water can float across the site without touching it if need be. Delicate artifacts will sustain their own reduced weight and may be moved into storage containers with the minimum of handling.

The removal of spoil may be facilitated by a number of tools now available to workers underwater with a great deal less effort than on land and large areas of loch bed are available for convenient dumping. Underwater areas for storage are also available for large finds which are not undergoing immediate conservation in a laboratory.

The final aim of this thesis is to demonstrate that the underwater excavation of crannogs is feasible, financially viable and archaeologically valuable.The developments in underwater excavation which have made this work possible are outlined in Chapters 6 and 7. Chapters 8 and 9 are the results of underwater surveys in two major Scottish lochs, Awe and Tay, supplying a context for the excavation of Oakbank Crannog. The work carried out there since 1980 is discussed in Chapters 10 and 11.

Chapter Six.

Underwater Methods and Techniques

Part One.

6.1 Introduction

This chapter is not a total exposition of the pros and cons of underwater archaeology in general. Such a broad view is not relevant in this thesis and has already been well-covered by a number of publications over the last twenty years (e.g. Bass 1966, UNESCO 1972, UNESCO 1981). The emphasis in past works has been on maritime or nautical archaeology and, as such, covers a wider range of topics than is necessary for this study. However, many of the techniques employed and a selection of the tools are directly applicable to the work carried out on sites like Oakbank, albeit with modifications. The underwater methods and techniques discussed below are only discussed with reference to Oakbank Crannog and though they may also be directly applicable to other crannogs underwater in Loch Tay or elsewhere this would only be apparent by practical demonstration.

6.2 Acceptance of Underwater Excavation.

Many archaeologists are reluctant to accept the concept of working underwater and the prospect is often not seriously considered. There are a variety of reasons for this. The practical problems which must be overcome before an underwater excavation is carried out are, in many respects, closely similar to those involved in preparation for a land dig. Background research and survey, administrative problems, organisation of personnel, acquisition of equipment and transport are basically the same in both cases. However, underwater excavation is not viewed as more difficult, more expensive or more inaccessible than land excavation to the majority of archaeologists. It is inconceivable.

For instance, if survey or excavation of a hill-fort is discussed with an archaeologist his experience allows a mental image to be formed, even if he has not recently seen the site. Few archaeologists have never visited such a site and even the layman has little difficulty in picturing a hill surrounded by a rampart. The inconceivable element in discussing an underwater site like a crannog is not the lack of imagery of the site (a mound of stones is easily described as analogous to a stone cairn) but the inability of a person who has never been underwater to understand what it is like to be in such an environment.

Underwater archaeology now plays a practical role in a number of institutions, such as the Scottish Institute of Maritime Studies at St. Andrews University or the National Maritime Museum, but this has done little to encourage or persuade the prehistorian to a greater acceptance of this branch of mainstream archaeology. In some cases the emphasis of work on post-mediaeval shipwrecks, and particularly those where treasure has apparently taken precedence over rigorous archaeological ideals, has done more to alienate professional archaeologists than to reassure them.

6.3 Early Underwater Observations.

The first archaeological work was restricted to observations and sampling of a cursory nature and the earliest recorded effort was made by a geologist Adolf von Morlot in Switzerland, in 1854. In that year the levels of Swiss lakes were unusually low and the recognition of groups of piles observed at that time resulted in the ensuing development of lake dwelling researches. On 24 August 1854 Morlot, with the assistance of Francois-Alphonse Forel and Frederic Troyon, descended down a ladder into the waters of Lake Leman at Morges near Lausanne to examine the ancient piles. His breathing apparatus consisted of a glass-fronted bucket with a tube to the surface, which would restrict his breathing underwater to within c. 50 cms of the

surface. He was equipped with a butterfly-net and rake for collecting samples (Speck 1981, 105, 130).

The earliest recorded underwater examination of a crannog in Scotland was carried out by two divers from the Crinan Canal on behalf of the Rev. R.J. Mapleton (Mapleton 1867, 322). The minister had suspected the existence of the artificial island in Loch Kielziebar, near Lochgilphead, Argyll. In 1867 he visited the loch accompanied by the canal engineer 'with a diving apparatus, and a staff of men' (ibid.). One of the major constraints against working underwater until the invention of the modern aqualung was the amount of equipment required and the number of men needed to operate it. A diver would be supported by two men to turn the hand-operated pump and at least two others to handle his air- and life-line. Mapleton's divers seem to have justified their employment, however, it is generally seen as unsatisfactory for an archaeologist to stay on shore and rely upon the observations of archaeological features by untrained divers.

In the first decade of the twentieth century, the Rev. Francis Odo Blundell from the abbey at Fort Augustus, Inverness-shire became the next person to examine crannogs beneath the surface (see above). In August 1908 in order to establish the artificiality of Eilean Muireach, or Cherry Island, in the west end of Loch Ness Blundell acquired the use of a diving suit and air pump from the Clyde Navigation Trust who maintained the Caledonian Canal.

He experienced few difficulties after initial problems of too much buoyancy due to over-enthusiastic pumping by his inexperienced assistants. The 'brass-hat' diving suit which he used was heavy and cumbersome and he would have required a dresser to help him kit up. The air hose and life-line would also be heavy and care had to be taken not to get them tangled though this would not have been a great problem in such shallow water. The heavy suit with its pair of 56 lb. lead-weighted boots would not have allowed him to swim free as in the case of modern equipment, and he would have been restricted to walking on the loch bed with the attendant risk of damage to the structure and raising silt which diminished visibility, as he records (Blundell 1909, 162).

Even with the restrictions of his antiquated equipment, which incidentally changed little until the 1960s for some work, Blundell recognised in various features the artificial nature of Eilean Muireach: the even pitch of the mound's rubble cover and the two layers of stones, large and small; the clearly-defined line between the crannog and the loch bed and the range of timbers projecting from the site; the causeway to the shore, a stone breakwater, and a sighting of a mass of vitrified material. His three descents on his first day of diving and their results proved the value of being able to go underwater to examine the site at first hand. It was particularly important at the period when he was working since crannogs had been assigned to the south-west of Scotland due to the impact of Munro's work,

except for solely stone mounds in the Highlands. Blundell proved this not to be the case and went on to establish the presence of crannogs with substantial timber elements elsewhere in the Highland lochs.

Blundell put the primitive equipment available to him to its fullest use in terms of underwater archaeology for his day. Even had the desire existed to carry out any more ambitious work it was not feasible until less bulky and cumbersome equipment had been developed and the only way to reasonably consider excavating an underwater crannog at that time would begin with draining it. After Blundell's underwater observations there are no records of other divers or archaeologists carrying out the same sort of work until the 1960s by which time significant changes had taken place in the standards of archaeological excavation and the type of equipment available for working underwater.

6.4 Modern Underwater Crannog Surveys.

In 1964 and 1965 Islay Archaeological Survey Group were surveying the remains on the island of Inchcailloch in Loch Lomond (Wallace pers. comm.. Unpublished report). As an adjunct to their work an expedition was set up by the British Sub-Aqua Club to establish which, if any, of the numerous islands in the loch were artificially constructed. By the 1960s the ease of transport and the simplicity of the equipment required for diving

meant that most Scottish lochs could be examined with little difficulty and crannogs could be surveyed on a scale not possible previously.

A full-scale survey has not yet been carried out in Loch Lomond but in 1972 a systematic survey of Loch Awe was carried out by archaeologists from the University of Edinburgh, Dr. and Mrs. T.D. McArdle and Dr. I. Morrison, and a team of Naval Air Command Sub-Aqua Club divers (Morrison and McArdle pers. comm.. PSAS next issue). The expedition will probably not be typical of underwater archaeological surveys or excavation in the future since the supply and handling of the diving gear was carried out mainly by the Naval Air Command Team who also supplied nine divers trained in underwater search and survey methods and accustomed to working in low visibility conditions. They supplied two boats with engines, compressor and air bank, thus taking much of the burden from the scientific members of the team. The discipline and organisation of this experienced group enabled sixty sites to be examined over the 90 kms of shoreline of Loch Awe in only two weeks. Twenty were confirmed to be artificial and were surveyed (PSAS forthcoming).

The requirements for underwater survey in terms of equipment are not significantly different from those required in the basic pastime of diving. A compressed air bottle and regulator, wet or dry suit, weightbelt, mask, fins and snorkel. The survey tools add little to these basic requirements. A compass, which many divers carry anyway, a 30 m tape and a 5 m surveyors staff are

adequate for shallow-water survey with more accurate or larger-scale work carried out using a theodolite or electronic distance measurer from a shore baseline.

6.5 The Development of Modern Underwater Excavation Techniques.

A number of underwater sites on the continent are presently undergoing excavation with exceptional results. These include the Mesolithic sites of Tybrind Vig, Denmark (Andersen 1984); the late Neolithic village at Les Baigneurs, Charavines, France (Bocquet 1979); and a palisaded village site in Lake Neuchatel, Switzerland (Ruoff 1980, 154). The underwater techniques used in the excavation of these sites were developed and established during excavation of a number of sites in the Lake of Zurich since 1963, by a team under Dr. Ulrich Ruoff, the archaeologist for the city of Zurich (Ruoff 1972, 123-137).

Ruoff has established standards which are comparable with land excavation and which others attempt to achieve. He saw four major areas of difficulty which it is necessary to overcome before accurate and efficient work can be carried out.

Disturbance of bottom sediments clouded the water to such an extent that precise work was impossible. He tried various methods of cleaning the water but eventually devised a new method. Water is pumped along a flexible pipe to a rigid tube 1 m long and 5 cms diameter. This tube is perforated along one

edge with three rows of holes through which the pumped water is forced thus creating an artificial current. The tube is so placed that excavated material guided into the current is carried away from the working area and the water is kept clear. A secondary function of the machine is as an excavation tool. When the jets of water are aimed at specific areas they wash out compacted material but great care has to be taken not to damage fragile deposits with the violent jet-stream. This tool is widely used on lacustrine sites and is the most useful excavation implement at Oakbank (see Ch. 6).

Site drawing was another area where difficulties were encountered by Ruoff. Photogrammetry and general photographic recording cannot supercede drawing in many cases for the same reasons as on land sites, but also because cloudy water can severely restrict light penetration. One of the major drawbacks of drawing underwater is that of parallax. The importance of viewing vertically an area to be drawn on a land site is well-known if distortion is to be avoided in the final plan. The problem is greatly accentuated underwater where refraction through the water results in far greater visual aberration. Ruoff pointed out that constant use of a plumb-bob was necessary to minimise errors but developed a less time-consuming method for his own work (Ruoff 1972, 128).

He used two grid frames, one above the other, with 5 cms separation. Adjustable legs enabled the frames to be horizontally aligned and when viewed from above verticality was assumed if the appropriate grid lines coincided.

Direct reduction of drawings is not an easy operation underwater, particularly when the draughtsman's hands are numb with cold. If gloves are warn to stay warm their bulk makes fine drawing difficult. Ruoff overcomes this problem by drawing at 1:1 onto Plexiglass plates. He found lipstick the best medium for drawing and speeded up the whole process by projecting the drawing to the required reduction on shore (Ruoff 1972, 130). Some of these processes are employed at Oakbank with good results (see below).

The difficulty of underwater communications between workers and supervisor is a problem on many underwater excavations. On some sites poor visibility exacerbates the problem as neither workers nor supervisor may be able to see more than small areas at one time. This also makes discussion on shore difficult as specific features cannot be indicated or directly referred to. Ruoff attempts to minimise the problem by having a permanent team of three highly trained excavators who are each conversant with all of the tasks to be carried out. Familiarity with the system of operation and with each other means that verbal communication is kept to a minimum and a higher level of mutual understanding is achieved. This problem is discussed in more detail below with

regard to Oakbank Crannog. It is sufficient to state here that financial stringency has made it necessary to employ voluntary labour and continuity of personnel has, so far, not been maintained.

A growing problem in many aspects of archaeology and particularly with regard to underwater remains is the question of conservation. The lack of facilities and inadequacy of techniques are becoming serious constraints in some areas. In Switzerland the overall budget available to Dr. Ruoff surpasses that available to most archaeologists in Britain, and since the level of conservation is often directly related to the financing of conservation facilities Ruoff has apparently not suffered greatly in this area. The co-operation of the available national agencies has also minimised the problem and Ruoff has few complaints, stating

> 'Conservation is the business of museum experts, and outstanding results (especially with wood and fabrics), have been obtained by the Schweizerisches Landesmuseum' (Ruoff 1972, 130).

Conservation of material from Oakbank is one of the biggest problems relating to the site.

Dr. Ruoff has, since 1963, been intimately involved in the excavation of lake dwellings underwater in the Lake of Zurich. Many of the problems of such work have been overcome and his aims of raising the standards of underwater excavation have been achieved,

'Thus we hope to emerge with our underwater sites dissected, recorded and interpreted to the same high standards as land-based archaeologists expect' (Ruoff 1980, 151).

6.6 Advantages of Lake Diving

Many of the so-called excavations carried out underwater in the past twenty-five years were of shipwrecks in the sea and although the best of the excavators produced important material and took great care to operate as professionally as possible they did so under difficult and dangerous conditions. Sites such as the Bronze Age shipwreck at Cape Gelidonya and a Byzantine wreck at Yassi Ada off the Turkish coast, excavated by George Bass and Peter Throckmorton in the 1960s, lie in water up to 45 m deep (Bass 1960).

The difficulties of working in such depths are many and varied and can usually only be overcome with considerable financial outlay. Large boats are required with the attendant costs of fuel and crew. Divers can only work for short periods at depth, for example 45 minutes per day at 40 m, unless expensive decompression chambers or diving bells are available. Many people consider these difficulties to be inherent in any sort of underwater excavation but this is not the case.

6.6.1 Depth.

The depth factor is one of the most important considerations on an underwater site. Decompression sickness commonly known as the 'bends' and nitrogen narcosis are two of the common problems related to depth but at less than 10 m depth they are not encountered. Since all known crannog sites, except those in lochs where the level has been artificially raised, are well within the 10 m range, work can be carried out for as long as required.

Another advantage of shallow water is that less air is consumed than at depth. This means that compressed air bottles last longer, from 1-1 1/2 hours at 5 m as opposed to c. 45 minutes at 20 m, cutting down the expense of filling them and the inconvenience of constantly changing them. Surface demand compressors which pass air along a line (see below) will supply more divers, four at 5 m as opposed to two at 20 m. Supervision is more convenient since divers can readily be brought to the surface for new orders or advice. Safety is also enhanced since a surface cover diver can actually see those working on the bottom at all times and can reach them quickly if the need arises.

6.6.2 Fresh Water

The fact that most crannogs are in fresh not salt water is another advantage. After salt-water diving all equipment must be washed thoroughly in fresh water if corrosion and rot are to be prevented. Fresh water is relatively harmless and the savings in time, by not having to clean equipment, and in money, not having to replace corroded gear, are considerable. It is also a great deal more pleasant to dive in fresh water. Sea salt is sticky and the taste is unpleasant to some people wheras Loch Tay water is clean and fresh. The visibility in many Scottish lochs is impaired by the peat colouring the water but in Loch Tay, at most times of the year, visibility is over 5 m and occasionally as much as 10 m.

6.6.3 Shelter and Tides

Most inland lochs are relatively sheltered particularly in Highland areas with mountains to break the force of the wind. Many days can be lost at sea because conditions are not calm enough for boats to stay on site or because large waves prevent shore entry. Such conditions rarely apply in lochs though larger examples may have a considerable fetch so that waves can build up. These waves are not normally as

big as at sea but because the work is in shallow water even small waves can affect work on site. Nevertheless, except at the equinoxes the problem is slight.

The effects of tides at sea can be inconvenient in two ways. Mooring lines and air lines from the surface to the bottom have to be constantly adjusted as the depth changes. They also sweep in different directions as the tide changes and one may become tangled with the other and with elements of the site. The difference in depth can also mean long treks with equipment down slightly-sloping shores when the tide is out where work is carried out from a shore base.

Currents caused by tidal streams can be severe and may curtail diving except at slack water, which is normally no longer than about one hour a day. This applies particularly around coasts with many small islands like the west coast of Scotland. Needless to say there are no significant tidal effects in inland waters.

One of the major advantages of working in lochs as opposed to the sea is the ease of access to the shore and to the facilities of roads, shops and accommodation. Pumps, compressors and equipment stores can be based on shore adjacent to many crannogs and boats may not be required except for safety. There is little problem of space on shore and reasonably comfortable facilities can be made available for site personnel.

Chapter Seven

Underwater Methods and Techniques

Part 2.

7.1 Methods and Techniques Applied to Oakbank Crannog.

Oakbank Crannog is the first crannog to be excavated underwater. Although consideration was given to the methods and techniques employed on other underwater excavations, particularly those carried out by Dr. Ruoff in the Lake of Zurich, conditions are not the same. For instance Ruoff excavates the old land surface which was the lake shore when habitation took place and which was only occasionally flooded before final inundation. Crannogs are artificial structures built on the loch bed which has always been underwater. The three seasons of work at Oakbank, preceded by the 1979 underwater survey, were to a great extent experimental and the aim was to develop the methods and techniques so that they became a matter of course. The ultimate aim, as in the case of Ruoff, was to excavate to a standard as high as that achieved on land sites.

7.2 Diver Comfort and Safety.

The only compromises made to archaeological rigour were related to diver safety and comfort: safety for the obvious reason that lives are more important than archaeological results and in an alien environment lives are at risk, and comfort because the discomfort of those working underwater directly affects the standard of work and the conscientiousness of the workers.

7.2.1 Safety.

It may be thought that an underwater site where a large proportion of the working area is normally within 1 m of the surface and the shore is 40 m away is a very safe site, and potentially this is the case. However, the chief danger of such a site is the shallowness of the water which can tempt even experienced divers to become complacent. It is constantly necessary to indicate that drowning can take place in any depth of water, even close to shore.

A more obvious source of danger is the slipperiness of the boulders over the crannog and adjacent to the shore and divers are exhorted always to keep their demand valves in their hand until they are ashore. If a fall happened even

in relatively shallow water and the diver did not have his demand valve to hand it may become jammed between the boulders or in some part of his equipment, robbing him of his air supply.

Another of the less obvious hazards when working underwater is that of over-exertion. This would only be likely to apply at Oakbank when boulder removal was taking place and many heavy stones have to be lifted or carried off-site. It is possible for a diver to breath so heavily that he cannot be supplied with air quickly enough by his demand valve. Such an eventuality should not be a serious problem if surface cover and other assistance is close by to help the person in distress to the surface. A number of precautions and safety measures are taken at Oakbank Crannog to maintain the safety of personnel underwater.

The most effective way of protecting the life of a diver in trouble is to remove him from the water and two precautions are taken to make this as simple as possible in Loch Tay. During the first season a raft was tethered over the site but it was not considered sufficiently stable as a platform and was replaced in later years by an inflatable boat, which is very stable. The second precaution was to build up stones on the site to form platforms which extended almost to the surface so that even someone unable to stand on the crannog surface can still reach above water level. During the period from late spring to early autumn the top

area of the crannog mound is approximately 1 m below the surface while at other times it may be more than 2 m deep. Excavation is usually organised to coincide with the period of shallow water. However, as excavation continues and the mound is removed so the distance to the surface is increased and eventually artificial platforms will have to be built or other precautions taken to ensure safety.

An element of safety is offered by the practice of using air lines from the shore instead of compressed air cylinders. The air line is less cumbersome and may be used for signalling to one diver that someone near him is in trouble or for pulling a person quickly from the water. There is also the fact that if the excavator is engrossed in his work there is no chance that he will run out of air by forgetting to observe the contents gauge. Air is supplied by a compressor on shore which is always maintained by an operator. If the engine driving the compressor should stop for any reason a full cylinder of compressed air cuts in with sufficient capacity to last for about one hour.

Although divers are impressed with the need to look constantly back to their own safety it is not left entirely to themselves. At least one diver acts as cover on the surface at all times and the machine operator on shore is obliged to keep a constant watch on those in the water. If more than two divers are working underwater or if two are working far apart, more surface cover is employed. Buoys

are moored round the site to keep boats off.

7.2.2 Diver Comfort.

Diving suits have undergone considerable development in the past twenty years and can now be expected to keep a diver in the sea warm for two hours or more, although many people have a much lower tolerance to cold than this even with a good suit. However, fresh water lochs are colder than sea water and temperatures vary little from summer to winter where there is a large reservoir of deep water. Loch Tay is 150 m deep with a volume of 1,585 million cu. m. and the temperature ranged from 5 - 10 degrees C in May of 1902 and 1903 (Murray and Pullar 1910, II.I:80).

Two types of suit are available, wet and dry. The wet-suit allows water to enter between the neoprene suit and the diver's skin. The water is warmed by body heat and warmth is maintained until the body is chilled. Such suits are commonly worn by excavators on Oakbank Crannog in summer and allow the wearer to work for about two hours, by which time he is usually shivering and numb with cold. The effect is less as personnel get fitter and more used to the cold, but a prolonged period of attendance on the site is required for the full benefit to be felt. To date the stays of many of those working on the site were relatively short-term.

Dry-suits are warmer than wet-suits but are more expensive. With these the diver wears as much warm clothing as is required to keep him warm and the dry-suit prevents water from entering. The best wet-suits are almost as warm as the least expensive dry-suits so warmth is closely related to site budget. It is notable that the dry-suits worn by Ruoff's permanent team of three divers cost about the same as the budget for three seasons of excavation on Oakbank Crannog, and Ruoff's divers are supplied with new suits every year (pers. comm.).

If underwater excavators are cold their abilities are retarded both physically and mentally. Bare numb fingers or wearing gloves make drawing difficult (see above). When the body chills the muscles become tense and it is difficult to stay relaxed. Progressively more consideration is given to the body's discomfort than to the area being worked until actual damage can result. The ability to concentrate also falls off with cold and the effects can be severe.

Notwithstanding the effects of cold in Loch Tay excavators regularly carried out six to eight hours work per day and sometimes more. Stops for a hot drink were beneficial but dedication and interest were the driving forces. Warm and dry accommodation is a necessity after work if morale is to be maintained. In 1980 the expedition camped on the shore of Loch Tay but the weather was cold and

wet suits never had a chance to dry and the members of the team slept badly in tents. Excellent work was carried out, but in subsequent years accommodation was in rented houses with significant rises in morale and work output.

7.3 Diving Equipment.

The types of diving suit available to the divers at Oakbank Crannog have been discussed above. In addition most members of the team wore waterproof trousers and kagouls or nylon jackets on top of their diving suits. These overclothes had some effect on overall warmth and also provided protection from tears and wear of the expensive diving suits.

Masks are standard half face-masks covering eyes and nose and are a matter of personal choice. Consideration of full face-masks is being made since they cover the whole face and would expose less skin to the cold water. They would also be more comfortable as the air supply vents into the mask and there is no need to grip a demand valve between the teeth, the continuous practice of which becomes uncomfortable and can eventually damage the teeth and gums. A further advantage of full face-masks would be the opportunity to use diver communications sets thus reducing the communications problems discussed above.

Snorkels are standard types, and usually carried though seldom used. Fins are not normally worn on site as they cause considerable currents and thereby disturbance of archaeological deposits and bottom sediments. They are of little use anyway owing to the considerable weight carried by the excavators to hold them steady on the bottom when excavating the delicate archaeological layers. If there is any wave movement, due to wind-driven currents, up to 35 kgs of lead may be carried round the diver's waist. Swimming is usually impossible, and the workers are required to walk across the loch bed to and from the crannog. The weight belts have quick-release buckles so that they may be quickly jettisoned in an emergency.

It has been recorded above that surface demand breathing equipment is preferred to compressed air cylinders for both comfort and continuity of working time. The system used is known as a 'hookah' and consists of a small compressor with an outlet of air at up to 12 atmospheres pressure, driven by a 4.5 h.p. petrol engine. The air passes round the machine's tubular frame to cool it then through a set of filters to remove water and oil. The air is then passed along from one to four lines to the divers in the water who breathe it on demand with a standard type of regulator.

The Honda petrol engine used to drive the compressor is reliable and economical and has been run for eight hours a day for up to three months at a time with few problems. It consumes approximately c. 7 litres of petrol per day. So long as care is taken to keep the compressor intake upwind of the engine and the filters are changed regularly the system can be relied upon to give a constant supply of good air. The machine used at Oakbank was manufactured to supply two divers down to 30 m but can be used to supply four excavators in the shallow water of the crannog.

Compressed air cylinders are used on site where freedom to move outside the immediate working area is required and as back-up for the 'hookah'. They hold 2.0376 cu. m. of air at 200 atmospheres pressure and will last for up to 1 1/2 hours in shallow water. The compressor used to fill them is a high pressure model which is noisy and relatively expensive to run, compared with the Honda, and its use is kept to a minimum. Single-hose demand valves are used to supply air from the bottle to the diver.

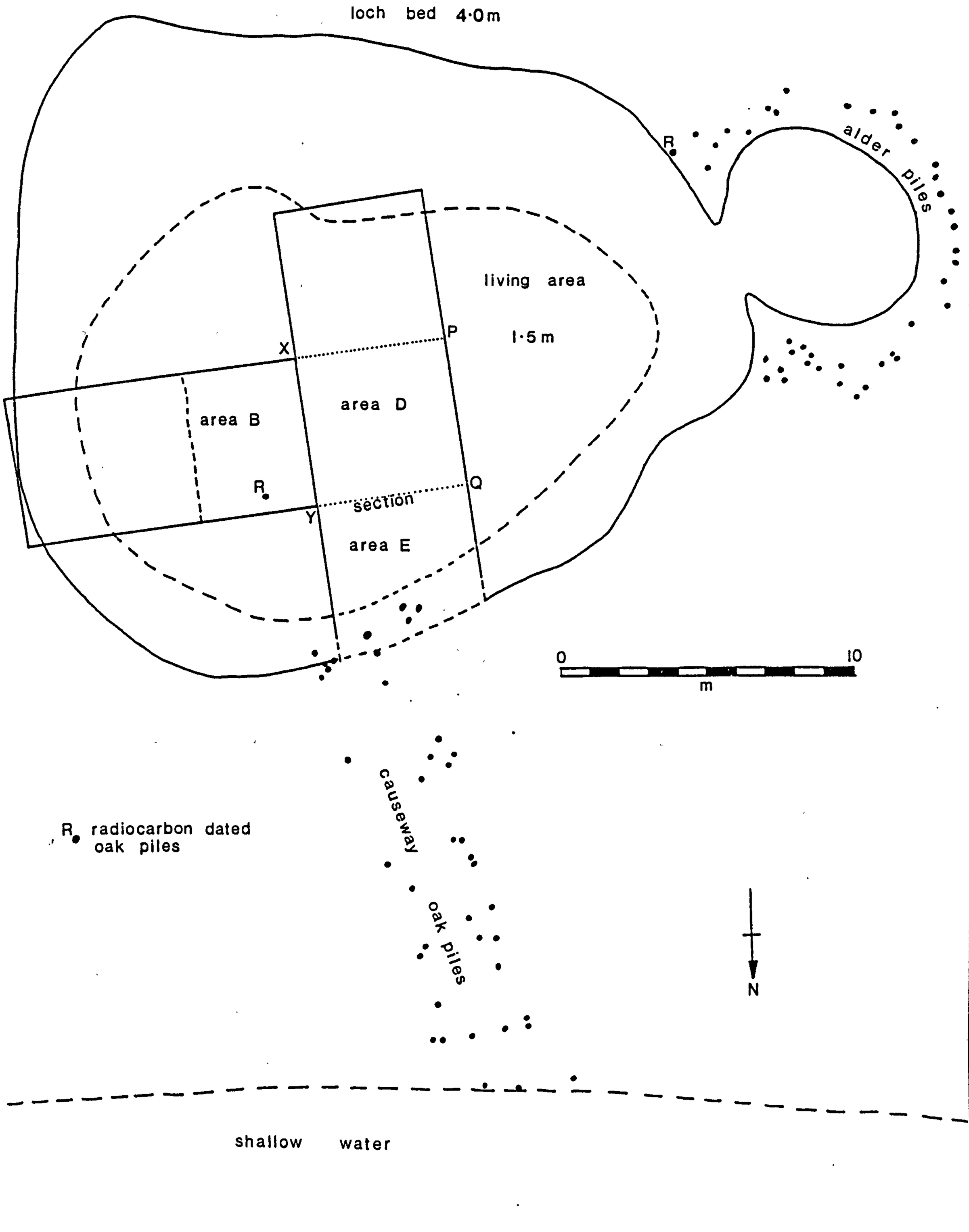
7.4 Excavation Equipment

A range of equipment is required for site preparation and excavation. A large canvas tent is pitched on the shore adjacent to the site to contain the 'hookah' and other gear overnight.

Prior to excavation a number of wooden control stakes were driven into the loch bed on the north and east sides of the crannog. Due to their depth below the upper part of the site and the fact that they could not be seen from there because of poor visibility, it was decided that they would not suffice as control points for finds plotting and site drawing. A metal frame 10m x 5m was therefore laid on the top of the mound enclosing the area to be excavated. The frame projected out from the top of the mound and two legs resting on the loch bed just out from the bottom edge of the crannog supported the outer end of the frame. The enclosed area was designated Area B (see fig 15).

This frame was constructed of 1" square Speedframe shelving struts and although adequate was not considered to be sufficiently rigid, although it remained in position. In 1981 Area D (fig 15) was laid out enclosed by another 10m x 5m metal frame this time made of much stronger tubular steel. Both frames have been underwater for a number of years but maintain their positions well after start of

Fig. 15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season adjustments. They are invaluable for plotting finds and plan drawing alignment. Consideration must be given to the eventual outcome of such a system since the frames must be either supported or removed when the parts of the site on which they lie are excavated. This is not seen as a major problem.

In 1980 the layer of large boulders in Area B was removed by lifting each stone onto a small wooden raft. When the raft was laden it was pulled along a line to a mooring buoy and dumped onto the loch bed some distance from the site. There were various problems with this method. The main one was the exertion of lifting heavy boulders above the surface and onto the raft but also occasionally if the raft was overladen it became top-heavy and deposited its load back on the site.

In the second season a much more efficient method was developed using a 14 foot Zodiac inflatable boat and a 1 m metal platform. The platform was suspended beneath the boat with two ropes at the front corners and a pulley system in the centre at the back. The platform hung just above the level of the area to be cleared so that it was a short lift placing the boulders on the platform. The buoyancy of the boat and strength of the platform meant that more than 500 kg per load could be carried. The boat was pulled along the line to the mooring buoy as before and using the pulley system the boat tender lowered the back end of the platform

so that the boulders fell off. He then raised the platform back to the horizontal position and returned to the working area. This method took a great deal less effort than the raft, and therefore lessened the risk of injury through strains or falling stones, and the whole system was very stable so that there was no chance of it tipping over.

The same mechanism was useful for removing smaller stones and gravel if the loch was calm but if there were waves material of small aggregate tended to be bounced off the bucking platform. In that case the excavators carried their buckets of spoil off the site directly to the spoil heap or dumped them into large circular plastic bins which, when they were full, were closed, rolled off to the dump and emptied.

An advantage over dry-land excavation was seen in the problem of moving boulders too big for two people to lift. A rope was tied round the stone and an inverted plastic bin or lifting bag attached to it. The bin was filled with air until the boulder was gently raised from the site by the action of the buoyancy in the bin. It could then be floated off to the dump. This method was used elsewhere for lifting weights many times larger than those found at Oakbank Crannog.

For keeping the water clear of silt and organic debris a current machine was employed similar to that used by Dr. Ruoff (see above). A water pump with an output of 300 litres/minute was sited on shore. It was coupled tc a fire hose, leading out to the site, which in turn was coupled to a steel pipe 1 m long and 10 cms in diameter which had a single row of 6 mm holes drilled along one edge. A strong current was produced which proved essential when heavy clearance was taking place or in the case of an area being cleaned to prevent small stones and organic fragments falling back on the cleaned patch.

A water dredge, using the same water pump as the current machine, also proved very useful on the site. The effect of this machine is similar to a vacuum cleaner. The excavator holds the front end of a long open pipe about 15 cms in diameter with the rest of the tube lying along the site behind him. Water is pumped through an orifice near his end of the tube so that it travels the length of the pipe behind him . This causes a suction at the front end of the pipe which the diver is holding and carries away material fed into it. This is a relatively violent machine which will remove stones large enough to enter the mouth and is seldom used directly on archaeological deposits. It is best utilised for moving piles of spoil which have already been collected.

Most of the actual excavation and cleaning of layers is accomplished by hand-fanning. A fanning motion of the flattened hand can cause very violent or very gentle currents in the water as required and is used for disturbing and transporting most types of material. In well compacted deposits a trowel may have to be used, and the whole range of dry site excavation tools may be useful, but only as an adjunct to fanning.

7.5 Surveying, Planning and Drawing.

Laying out semi-permanent control points to enable general survey of the site is no more difficult than on land and sometimes easier since the surrounding loch bed is clear of obstructions and easy to penetrate. There are no animals or human interference to move the pegs from year to year. Plastic or metal pegs are advised since the buoyancy of wooden ones tends to draw them slowly from the bottom silts. The pegs can be used for tape triangulation but obviously not for theodolite positioning since they are 3 m or more deep.

Tape surveys are difficult underwater since the poor visibility can prevent the tape being observed along its entirety. Constant checks have to be made to ensure that it has not snagged on stones or weeds and even slight water movement can cause inacceptable billowing. Also this method of surveying is time consuming. The longer the surveyor is underwater the colder he gets and the greater the chance of making mistakes. It is also more difficult to record lists of numbers legibly when cold.

A theodolite can be operated from shore to measure distance and angle of a staff placed on salient points by a diver. The problems with this system are that the diver gets very cold standing still and holding the staff vertical, and a surface snorkeller is required to pass messages from theodolite operator to diver, employing more personnel. If tapes are used for measuring inaccuracies are introduced due to the distances covered, up to 50m at Oakbank, and the problem of tape billowing which is worse on the surface where the effects of wind are added to those of water movement. Triangulating with theodolite is time consuming.

The best method for speed and accuracy, employed at Oakbank, was the use of an electronic distance measuring instrument, in this case the Distomat. The angles are read from a horizontal scale as with a theodolite but distances

are measured electronically. The staff held by the diver has a prism attached to the upper end which reflects an infra-red beam back to the machine on shore giving a highly accurate distance reading very quickly.

The system is so accurate that individual piles in a group, such as the forty piles along the causeway or the forty piles around the extension, can be positioned to an accuracy of 5 cms over 50 m. The results have been replicated from day to day. The speed of the operation is such that the diver and snorkeller are in the water for the minimum period of time necessary and the site work routine, which may have to be postponed during the survey, is quickly resumed.

There are no restraints to drawing, recording and note-taking underwater. Plastic pads can be made by roughening white perspex with emery paper and normal pencils can be used on them. Plastic drafting film, such as Permatrace, is not affected by immersion and can be used for writing or drawing on site (see Martin 1981). Fibreglass tapes are also unaffected by being underwater and finds and small features can be planned-in just as on land. The only precaution necessary is to ensure that the length of tape used can be seen and is not snagged but this does not present a problem over short distances up to about 5 m.

It is useful to have plans of previous work for the excavator's to refer to on site particularly when drawing or examining features. Numbers on piles are occasionally washed off by water movement and can be readily renewed if the plan is available. Paper drawings may be pasted to a formica board and covered with clear cellophane which is taped round the edges.

The subject of planning and recording materials is well-covered by previous writers (e.g. Martin 1981, Bass 1966).

During the 1980 season at Oakbank the site was drawn using the usual land method of laying a 1 m grid, with intersecting string at 20 cms intervals, on the area to be drawn and reducing the drawing directly at 1:10 onto graph paper. This method was adequate when the water was flat calm but the problems experienced by Dr. Ruoff (see above) of parallax and the difficulty of chilled divers drawing reduced plans accurately, were experienced. It was decided to attempt drawing at 1:1 on clear plastic sheeting and reducing the drawing to 1:10 on shore.

Owing to the high cost of perspex and the fact that its brittleness could cause it to break suddenly and dangerously, two sheets of clear polyethylene were bought. A slight blue tint brought the price down and made no

difference to the clarity. Various materials were tried on the surface to obtain the darkest image and artists oil pastels proved the best.

The process of drawing was greatly speeded up by this system and there were significant improvements in accuracy. It was found that by the time one square metre was drawn and brought to shore the previous square had been reduced onto the master plan and the cleaned sheet of plastic was ready for use, so very little time was wasted in the whole process. Drawing could be carried on even in quite rough conditions which would certainly have curtailed operations using the previous method.

7.6 Visual Recording and Graphic Presentation of Submerged Crannogs.

As a result of their location in or under water, crannogs are not readily visible to the intending observer. Even those which project above the water surface as islands often have a different shape and form below water level, as can be seen in the cases of Eilean nam Breaban (number 6 in App A, pl A4) and Croftmartaig Island (number 16 in App A, pl A7) in Loch Tay. Both of these structures appear as small roughly circular islands when observed from the shore but surveyed plans or aerial photographs show a very different shape underwater. In the case of submerged sites

not only can they not be observed from shore but even divers underwater do not perceive their whole outline owing to the large size of the mounds and the peatiness of the water, and because the angle of viewing is necessarily very low. The same restriction applies to large areas undergoing excavation and to extensive features which might not be recognised as such when seen piecemeal.

A number of techniques have been tried to represent the crannog at Oakbank as realistically as possible. In some cases the intention was to display the whole site and in others to show elements exposed during excavation. The methods used range from aerial photography to computer graphics with varying degrees of success. The work is experimental and a high level of flexibility is required in the choice of method since the particular situation may prevent the use of certain techniques. For instance, the depth of a site may prevent photography through the water surface. The attempt to present the site as a whole is not only for the benefit of the excavators but is also seen as important in clarifying the form of crannogs for other archaeologists who cannot venture underwater.

The methods attempted so far and the degree of success achieved are covered under a number of headings:

1. Aerial photography
2. Subjective planning
3. Objective computer-drawn contour planning

4. Three-dimensional computer graphics

5. General feature photography underwater

6. Photomosaics

7. Bi-pod excavation photography

8. Practical model building

7.6.1 Aerial photography.

An aerial survey of the artificial islands in Loch Tay was carried out in the summer of 1979 by Michael Brooks of the Central Excavation Unit, Ancient Monuments Branch of the SDD. A small helicopter was used since the steep shores of the lochside offer no emergency landing facilities for a fixed-wing aircraft. Colour slides were taken with an Olympus 35mm camera and black-and-white prints with a large format Hasselblad with high quality results in both cases.

The overall impression of the crannogs was very good, in some cases exhibiting the shadow of the lowest boulders on the loch bed in over 3 m of water (pl A3). However, a full outline of the bottom of the sites was not clear due to a variety of circumstances. The shadow of the mound obscured the lower edge of the crannogs on the side furthest from the sun and if the sun was hidden by clouds it was difficult to see the stones in detail. Wind-generated ripples on the surface obscured and distorted smaller features and where the site was too deep it did not show up at all through the water

An aerial survey of this sort is valuable in confirming the general shape of sites which are to be planned more accurately and for supplying an impression of crannogs for the benefit of those unfamiliar with them, but except under excellent conditions of weather, water clarity and depth the results are not sufficient for accurate planning.

Disadvantages of this method are the expense of hiring the helicopter and the fact that it will not necessarily be available at the most convenient times and weather conditions. Research into the possibility of using balloons or kites for convenience and lower cost will be carried out in the future. These techniques may also be useful in locating sites during survey work.

7.6.2 Subjective planning.

The Loch Tay crannog survey employed a tape and staff method of planning the sites which was simple and relatively accurate (see above Chapter 8). It was subjective in that the staffman had to decide where the sloping sides of the stone mound levelled off and became the top working area and which arrangements of stones constituted features. An important benefit was the familiarity which the surveyors developed with the type of site.

The graphic representation of the results from the survey has not yet been satisfactorily established. Hachuring was used for publication of the gazetteer (see Appendix A) in an attempt to present visually the shape of the mound with an appended section drawing to show the position of the site in relation to the water level on the survey date. The method is adequate for crannogs with a large surface area in proportion to depth but is less clear for steep-sided sites with a small top area such as number 9 (pl A5).

The survey of crannogs in Loch Awe (see Chapter 9) employed the same technique for planning as that used later in Loch Tay but the sites are illustrated in a different way (see Appendix A). A continuous line represents the bottom edge of the site and broken lines indicate the positions of other salient features such as the water level, break of slope onto the flat top and mud level. This more schematic technique is clearer where a number of embedded features, such as harbours, are shown but does not give such a visual impression of the mound. Neither method is particularly satisfactory and it may be that an isometric projection, possibly produced with the aid of a computer, would be preferable (see below).

7.6.3 Computer-drawn, objective contour survey.

During the 1979 Loch Tay survey Oakbank crannog was planned more comprehensively than the other sites in an effort to gain more objectivity and accuracy. The loch was calm and the water level was used as the datum. A tape was strung from a theodolite on shore to an inflatable boat, which was kept in position on the theodolite crosswires. A diver with a staff took a depth reading every 2 m along the tape. The theodolite was then moved 2 m to the side and the depth readings were continued. Altogether 256 readings were taken over the site.
Eventually a square grid of depth readings taken every 2 m covered the site. They were used as data for a computer graphics program which produced the contour plan (fig 16). The result is an accurate representation of the irregular main mound with the extension on the west and the low ridge of the causeway remains running off to the north. At least one more row of readings, and probably two, should have been taken on the east side and another row on the south.

The problems of this method are all related to the practical survey. A minimum of four people was required to operate the equipment and the project took a day and a half to complete. It was fortunate that the weather conditions were calm and sunny but such a situation could not be relied upon. The theodolite had to be set up sixteen times on slippery boulders and a skilled operator was required to handle it and another to drive the outboard-engined inflatable. It is doubtful whether the effort involved was worth the gain in accuracy over the tape survey plan; however, it is possible that similar results could be achieved with fewer readings

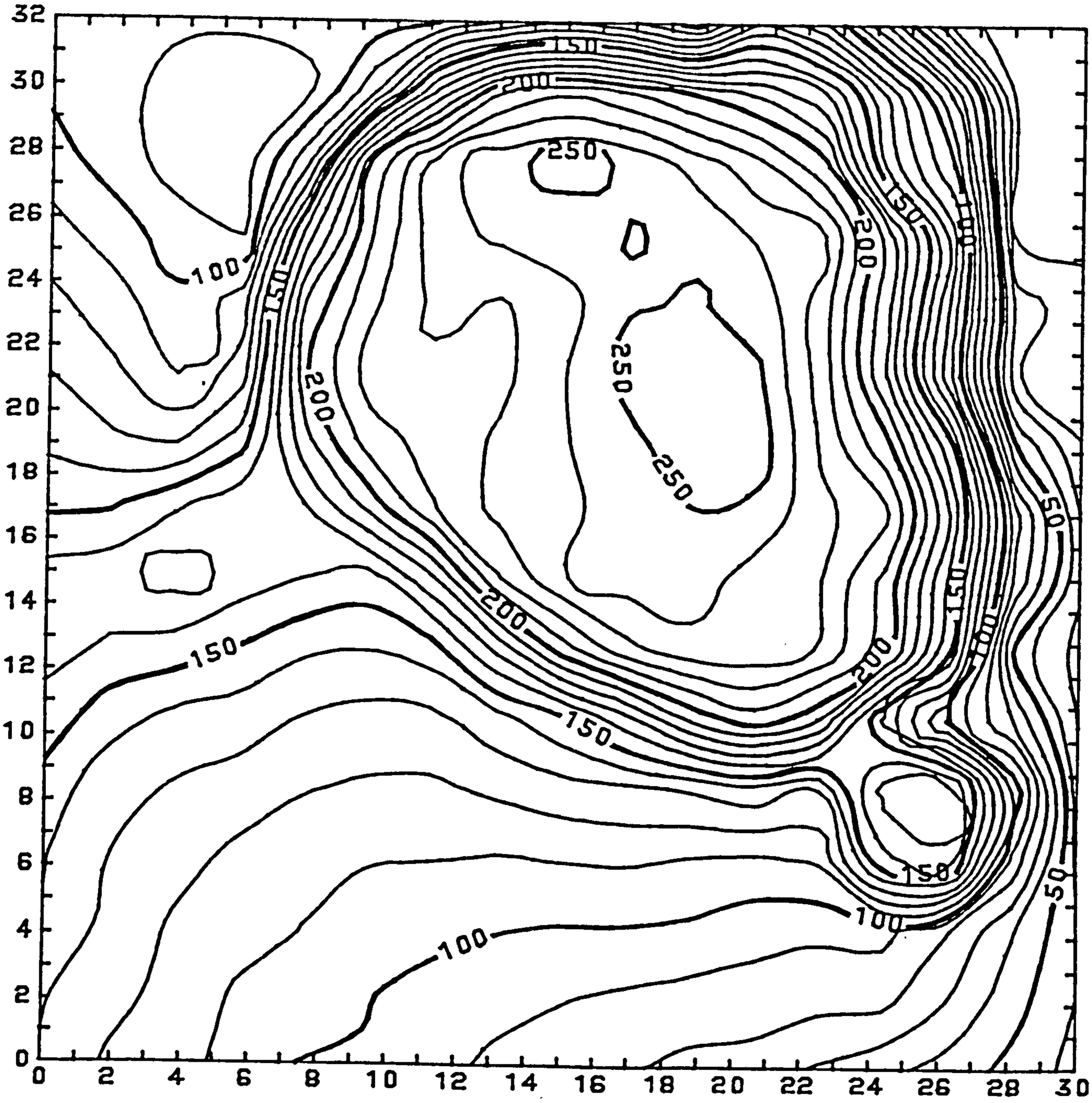
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Fig. 16

of a more random nature. The balance between the effort and expense of the practical survey and the quality of the end result has not yet been established.

7.6.4 Three-dimensional computer projection.

The same data and the same program suite which produced the contour plot was used to create three-dimensional projections of the crannog (figs 17-20). Views from two directions are illustrated and one of the sets has an over-emphasised vertical exaggeration. The image can be viewed from any direction and the line of sight can be depressed or elevated. The over-emphasised vertical element (figs 19 and 20) exaggerates features of the site so that they are more obvious than in the normal view (figs 17 and 18) and are more readily distinguished while the unemphasised projection is more realistic.

As in the case of the contour plan a good visual image is produced, however, it is misleading since the computer program 'rounds-off' sharp breaks in slope thereby supressing the desirable subjective elements recognised by the planners. In particular, the change between the crannog's stony bottom edge and the flat, light-coloured loch-bed silts is very obvious in fact but is smoothed out by the program. A combination of the computer's versitility in presenting and storing different views of the site but incorporating breaks in slope and other features would be more representative. These requirements should be possible using modern computer graphics capabilities and work continues in this area.

CRANNOG - TRANSECT 11, AZIMUTH 295, ELEVATION 45

PLOT NO. 4 DATE 05/28/84 TIME 20.06.04

AZIM = 295.0 ELEV = 45.0 DIST = 10000

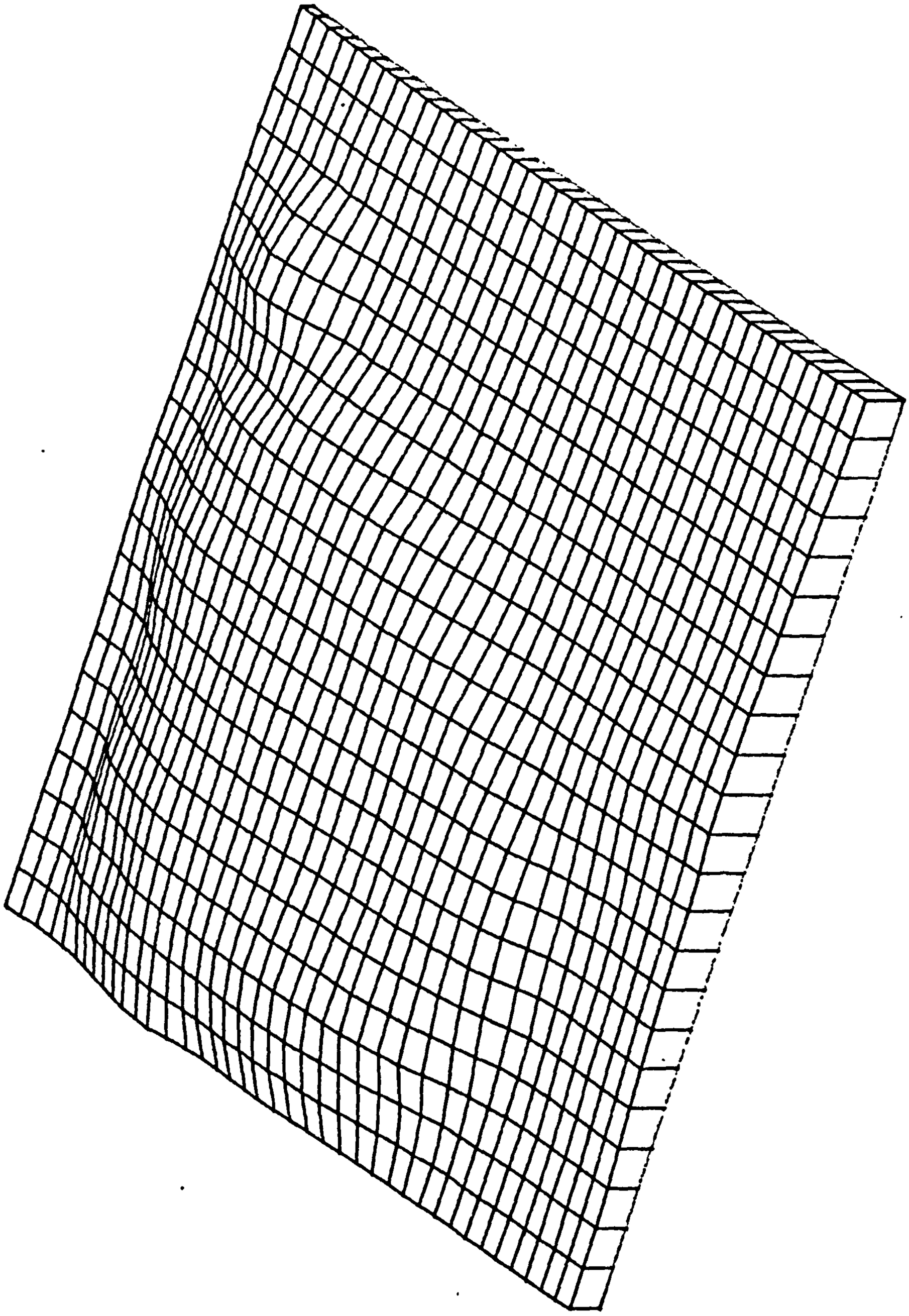


Fig. 17

CRANNOG - TRANSECT 11, AZIMUTH 25, ELEVATION 45

PLOT NO. 2 DATE 05/28/84 TIME 20.04.02

AZIM = 25.0 ELEV = 45.0 DIST = 10000

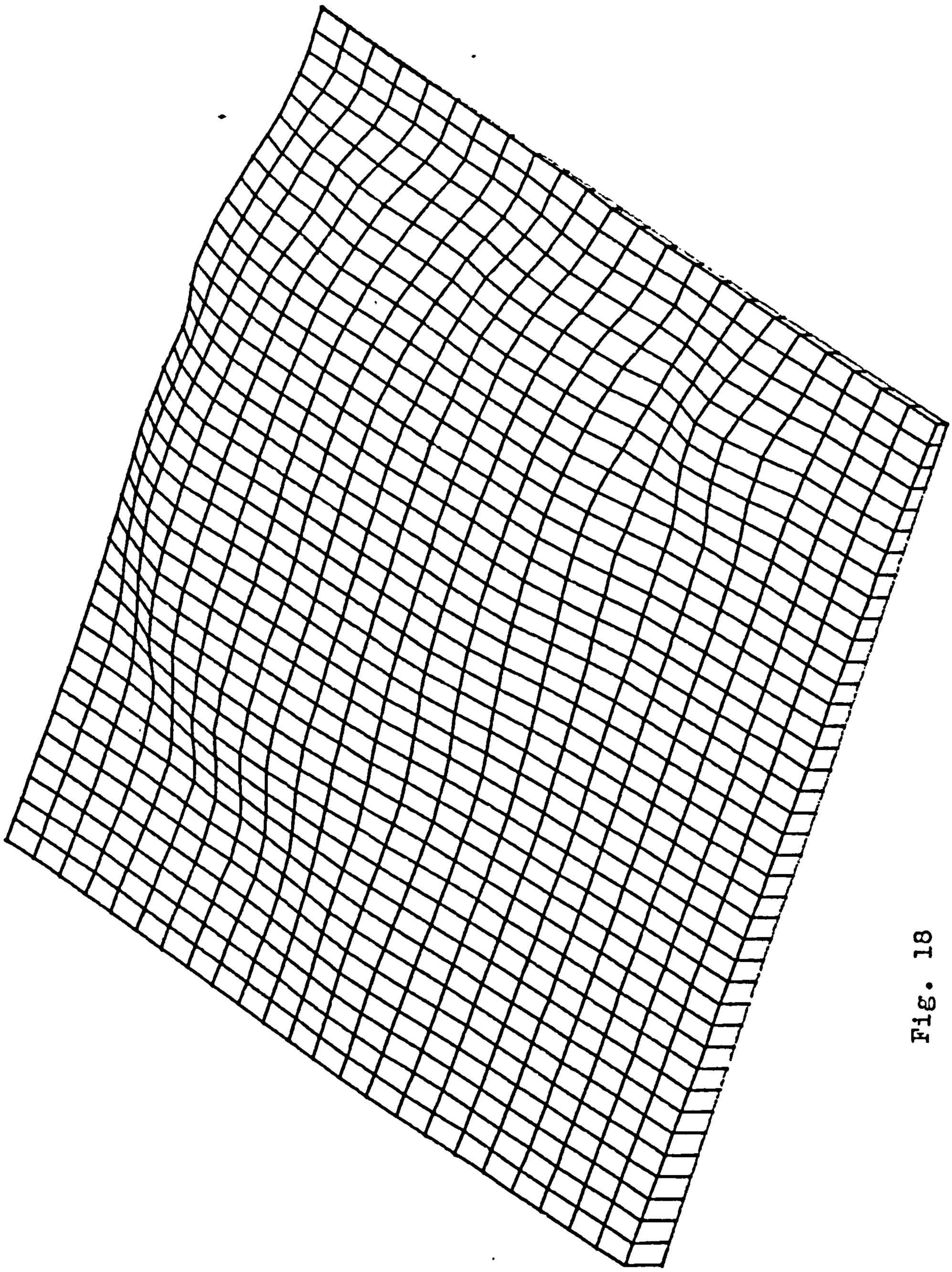


Fig. 18

CRANNOG · TRANSECT 30, AZIMUTH 285, ELEVATION 45

PLOT NO. 5 DATE 05/28/84 TIME 20.07.01

AZIM = 295.0 ELEV = 45.0 DIST = 10000

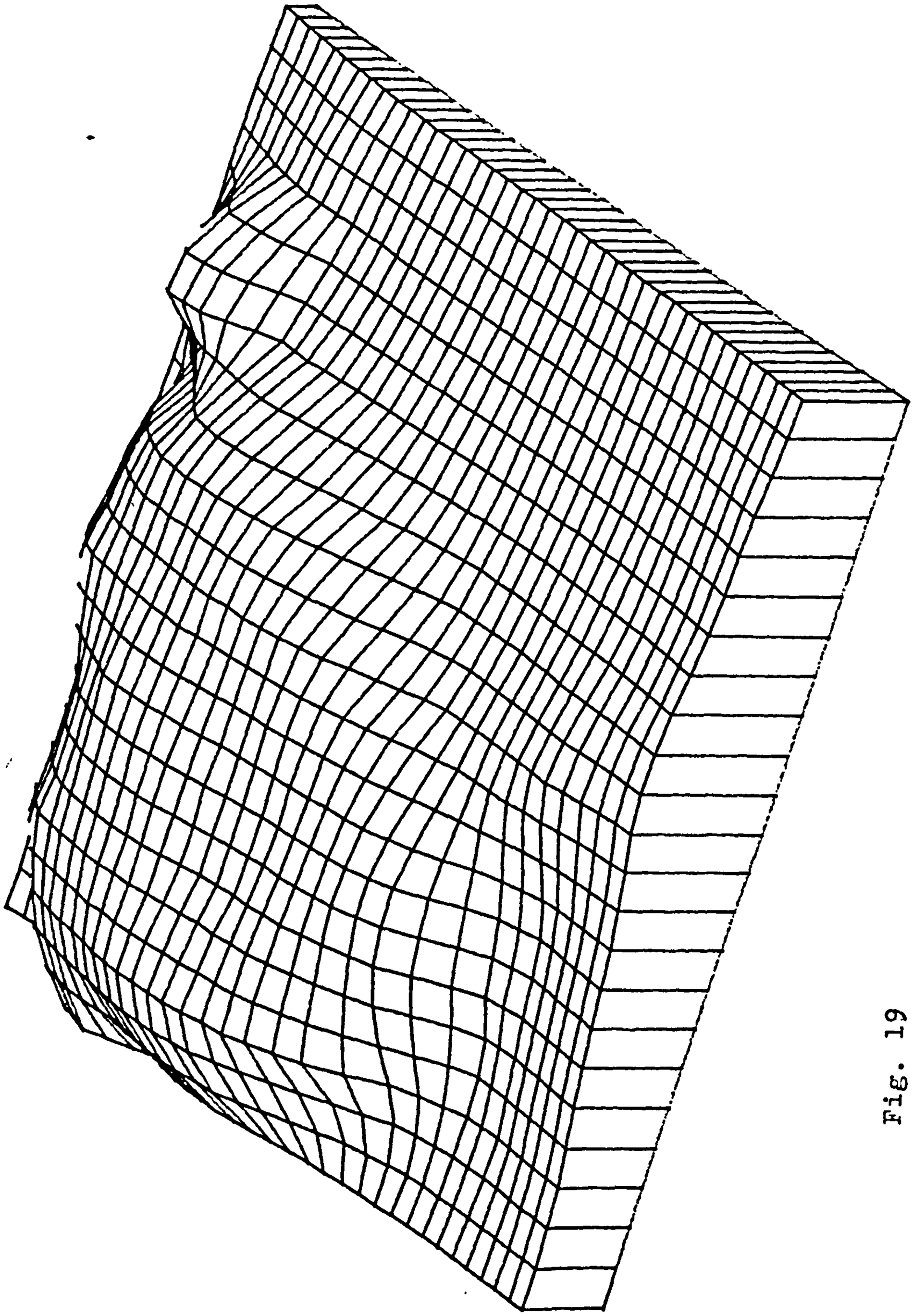


Fig. 19

CRANNOG - TRANSECT 30, AZIMUTH 25, ELEVATION 45

PLOT NO. 3 DATE 05/28/84 TIME 20.04.57

AZIM = 25.0 ELEV = 45.0 DIST = 10000

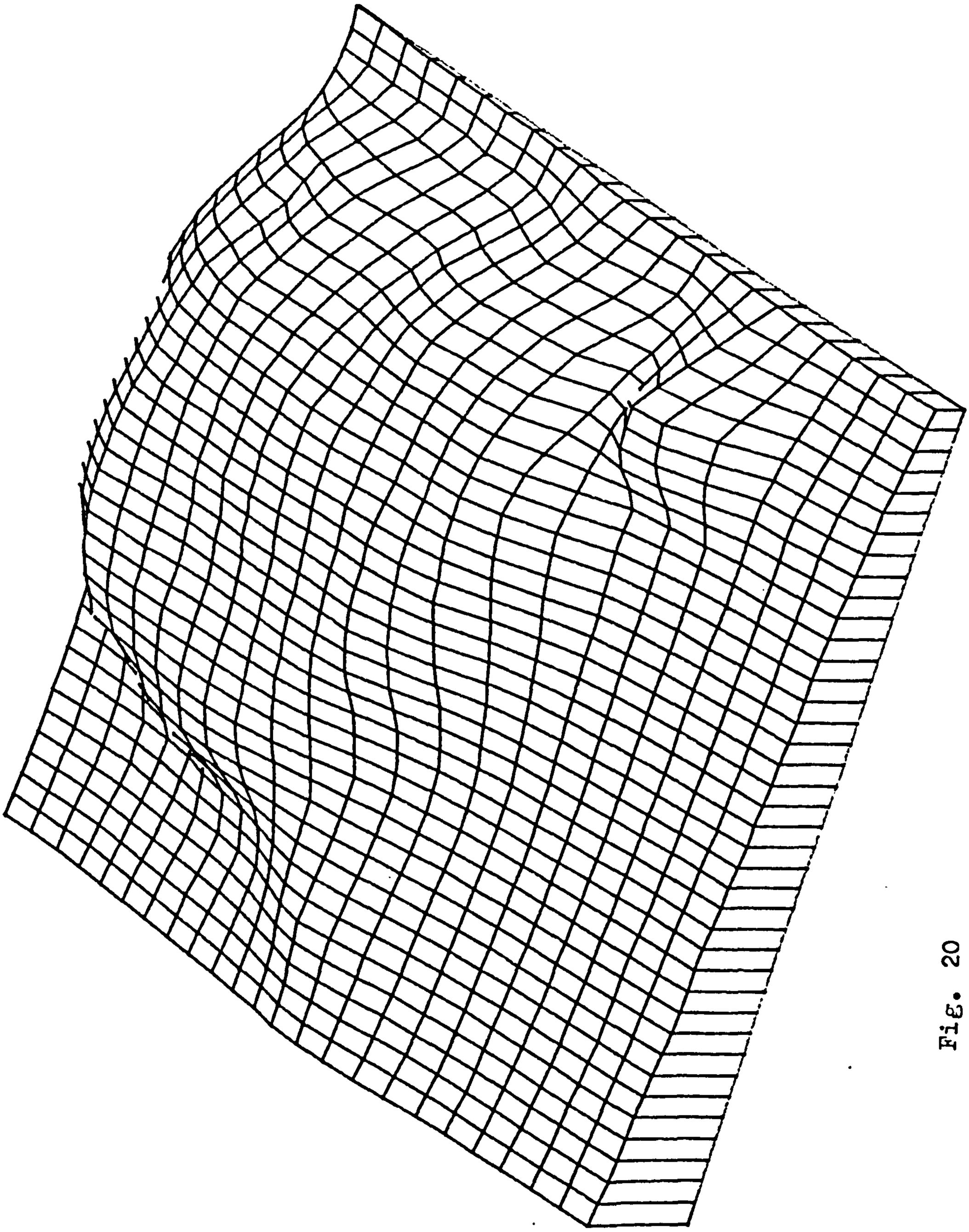


Fig. 20

7.6.5 Photography.

The above methods have been used at Oakbank crannog to represent the site as an entity but it is also necessary to illustrate parts of the site prior to and during excavation. Planning and drawing of excavated areas is carried out as on land for the detailed recording of the site (see Chapter Six) but photography plays a greater role in most underwater excavations and is particularly useful at Oakbank. The photographs are not just for record purposes but also to demonstrate to those who cannot dive the nature of the site and the work being carried on there. The texture and colour of the organic matrix may be shown, to a certain degree, by colour photographs.

It is felt necessary to demonstrate the rapid change that takes place in the colour of all vegetable materials after exposure. On first being uncovered wood, seeds, bracken, nuts and other organic finds are the same fresh colour as that of new material but within fifteen minutes or so the intensity of the colour has faded until eventually a dark charcoal grey is reached with no evidence of the original freshness. The effect of the process can be seen in plate 4 in which the centre of the picture, where a stone lay, is newly uncovered and the surrounding area has already faded. Plates 5 and 6 show an area of section before and after cleaning and illustrate the freshness of newly-exposed material. In the case of artifacts the effect can be dramatic as in the photographs of the wooden plate in situ and in the laboratory (pls 7 and 8). The different textures of the organic deposit can be seen in plates 9 and 10 though the range cannot be fully illustrated since they merge into each other

area c. 15 x 20 cms

Plate 4

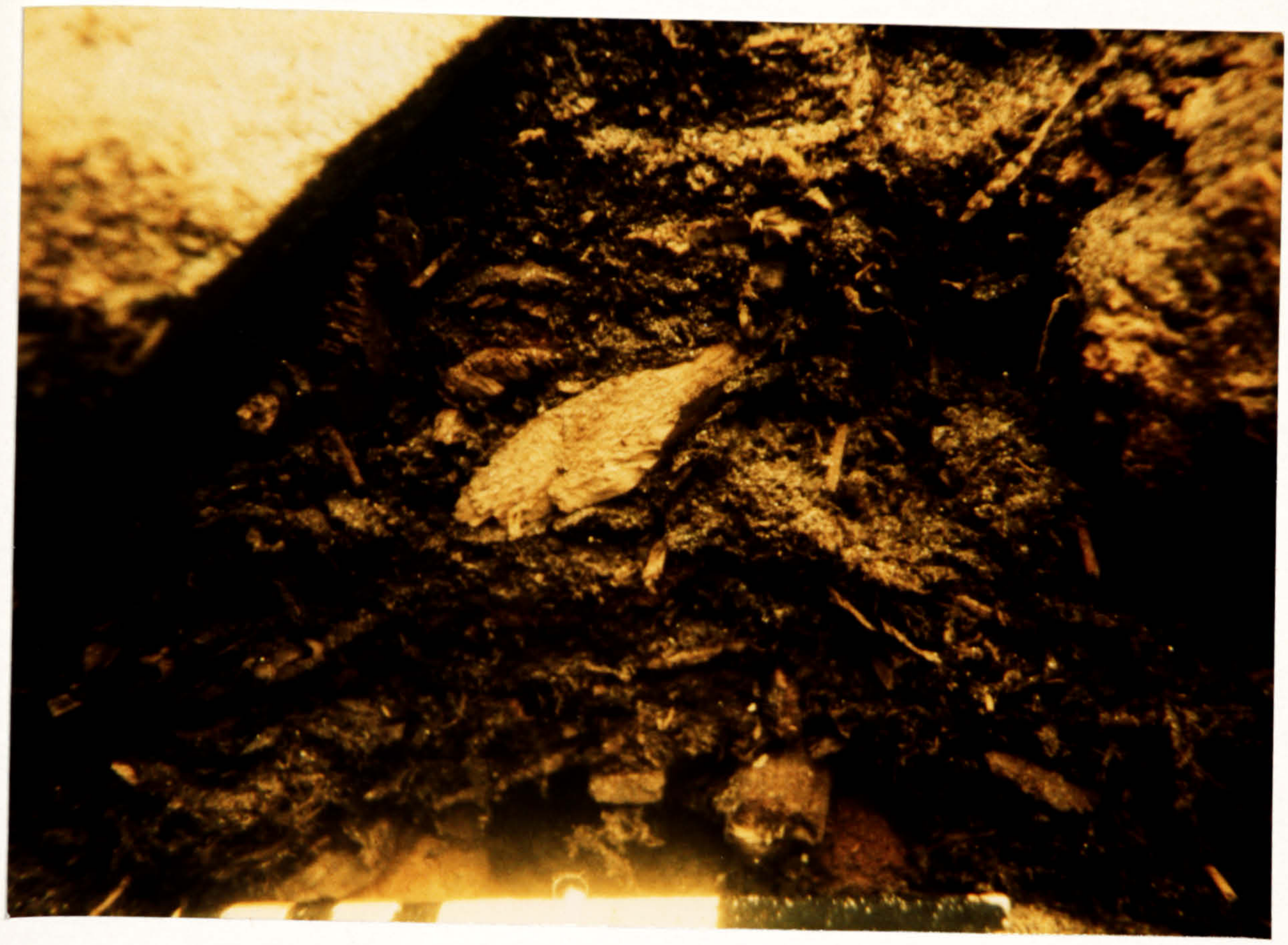


Plate 5

Plate 6

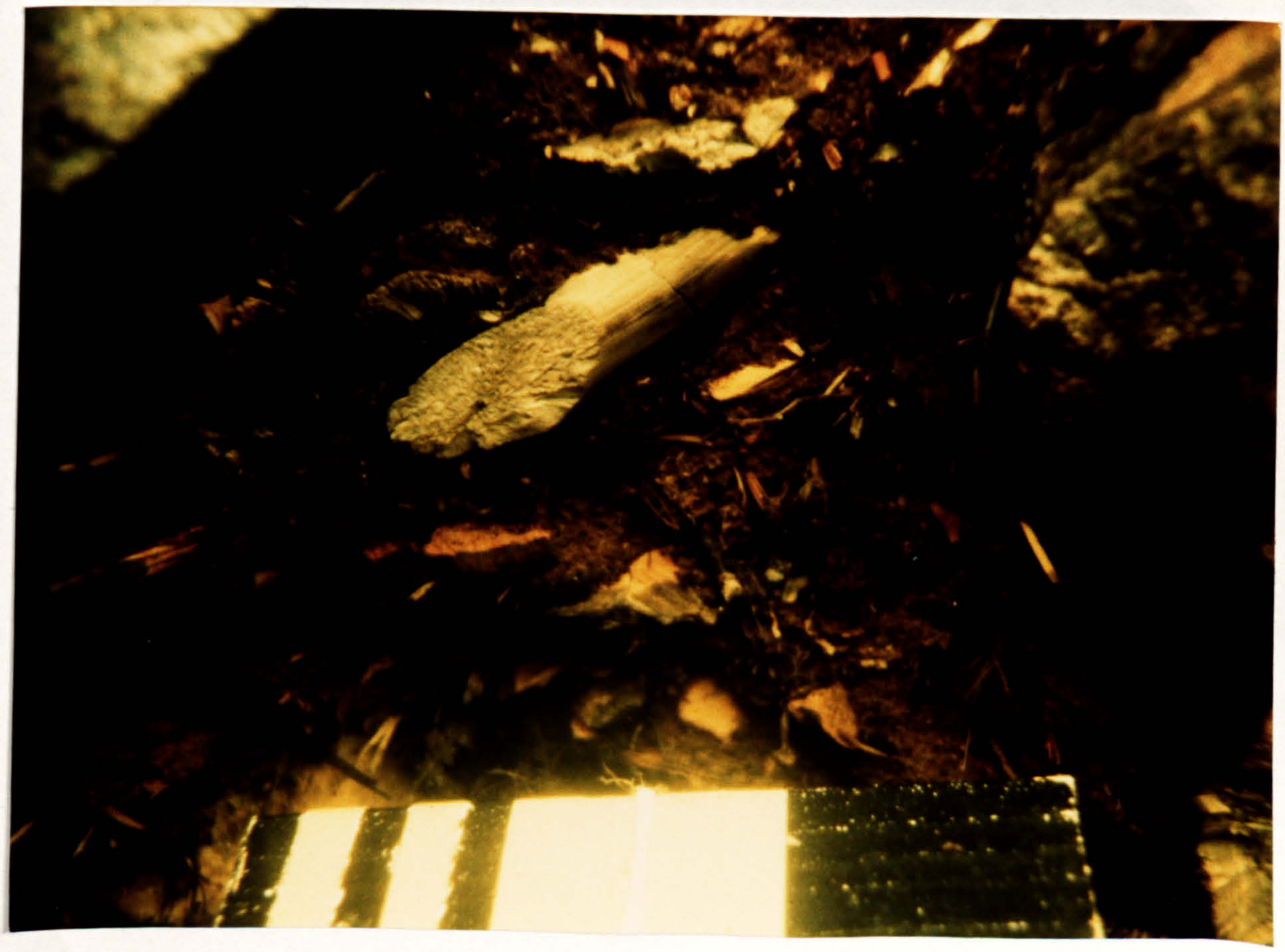


Plate 7

Plate 8

Plate 9

Plate 10

with no clear boundary.

7.6.6 Photomosaics.

Since the boulder cover did not seem to have been laid systematically and a pattern was not evident it was considered sufficient to record those in the areas to be excavated by photomosaic. The results were not very satisfactory due to the fact that the depth of water over the top of the site was not sufficient to allow an adequate distance between camera and subject. This meant that a very wide-angle lens had to be used to cover a reasonable area resulting in considerable distortion in all except the centre of the frame. A better result could be achieved on deeper parts of the site or by carrying out the operation in winter when the water is 1.5 - 2.0 m deeper, thus enabling a less distorting perspective to be used. So far only the top boulders have been considered for this type of coverage but features such as floor timbers and groups of piles may be usefully illustrated by photomosaic if the problems of distortion can be overcome.

7.6.7 Bi-pod excavation photography.

In an effort to obtain vertical photographs of the excavated areas a bi-pod of scaffold poles was constructed and erected over the crannog. The apex was about twenty feet above the site and a Canon 35mm camera was raised to the top on a pulley. The shutter was released with a long air-release but since the camera was not fitted with a motordrive it had to be lowered after each shot to wind on to the next frame.

The set-up was experimental but the photographs which were obtained showed a great deal of potential (pl 11). Piles and horizontal timbers were clearly distinguished though the uprights could have been marked with white discs to make them show up more clearly as demonstrated at the site of Les Baigneurs in France (Bocquet 1979,51). Ripples on the water are more obvious at this low level and water penetration is enhanced using polarising filters to cut down surface reflection. Further research will be carried out on this system in the future.

7.6.8 Practical model building.

One of the most frustrating aspects to develop during the excavation at Oakbank was the lack of immediately perceptible order or pattern in the large number of piles exposed. Except for F22, an arrangement of radically aligned walkway supports, and the partition supports F7 (see Appendix B and Chapter Ten), the great mass of uprights could not be seen as representing specific features when observed in situ. This was due to three main reasons. First, more than one phase of building accounted for the piles and stakes and, since the tops of them were eroded to a common level, it was not possible to distinguish the different phases without total excavation or the use of laboratory techniques. This meant that a much greater number of uprights than would have been extant during occupation were being observed together. Second, many of the uprights were sloping, presumably mainly because of structural collapse,

Plate 11

and did not appear in their original positions when first observed. This situation became less confusing as excavation proceeded and the direction and angle of slope could be used to work out the original position of the point. Third, the impracticability of observing all the timbers at once and the poor visibility underwater made it impossible to view the area as a whole.

The situation was slightly clearer when the site plans and sections were referred to but still, though some groupings were suggested, they were not diagnostic of the part of the platform or dwelling which was under examination. Part of the problem was that the drawings tried to represent in two dimensions what is a three-dimensional area with piles standing up to a metre high. Accordingly it was decided to make a simple three-dimensional model based on the site plans with sticks in the positions where it was decided the uprights had been placed rather than where they now lay. The extrapolated positions were to a certain extent subjective, since the bottoms of many uprights have not yet been excavated, but the results clearly demonstrate a more coherent view of the structure (pl 12). The model was particularly useful for breaking down preconceived groupings based on early observations of the tops of piles and for indicating associations which had not been previously considered. It also emphasised areas in which greater care in recording and examination were required such as an accurate determination of the direction and angle of slope of uprights which would allow more accurate calculations of their original positions before complete excavation.

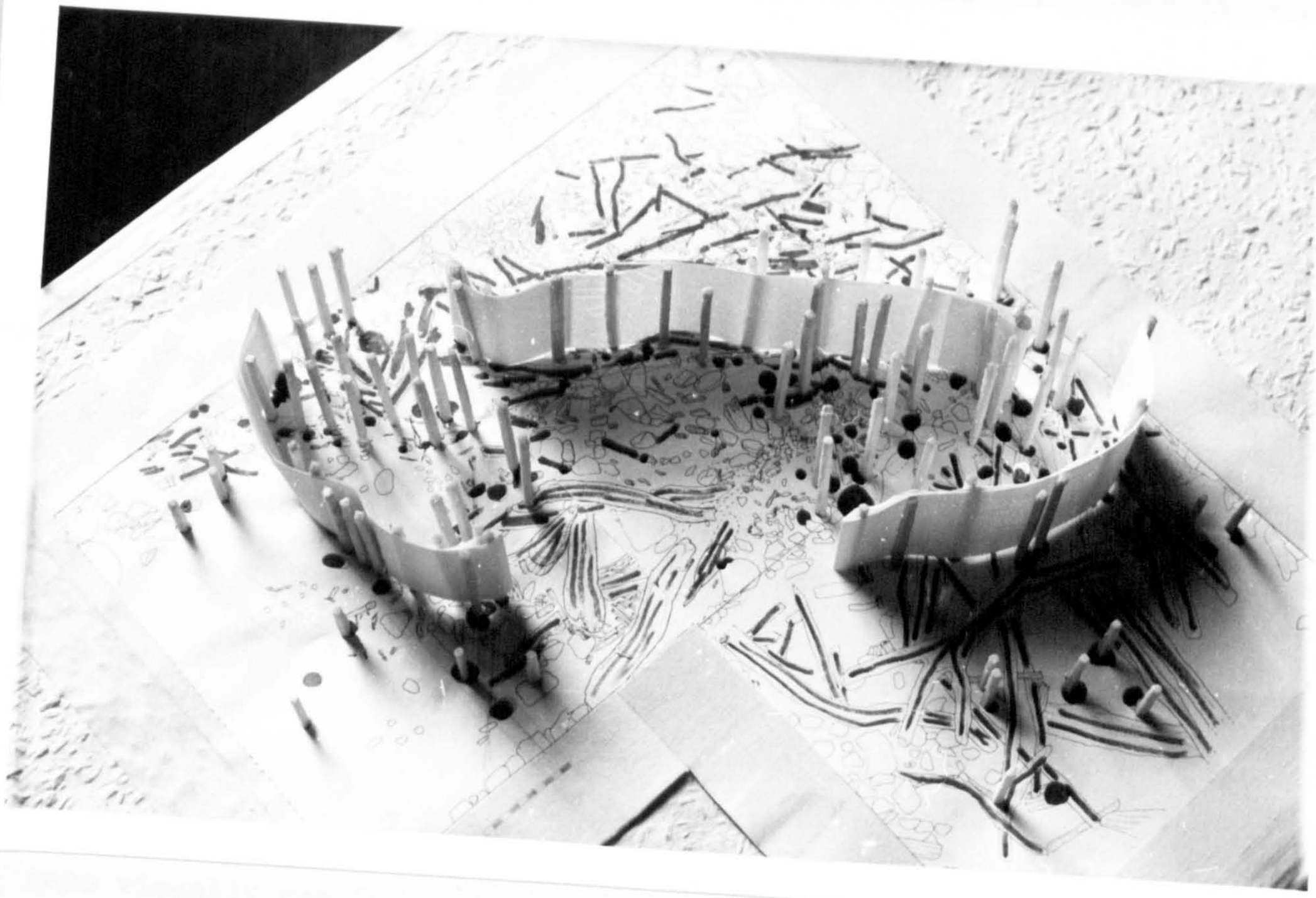
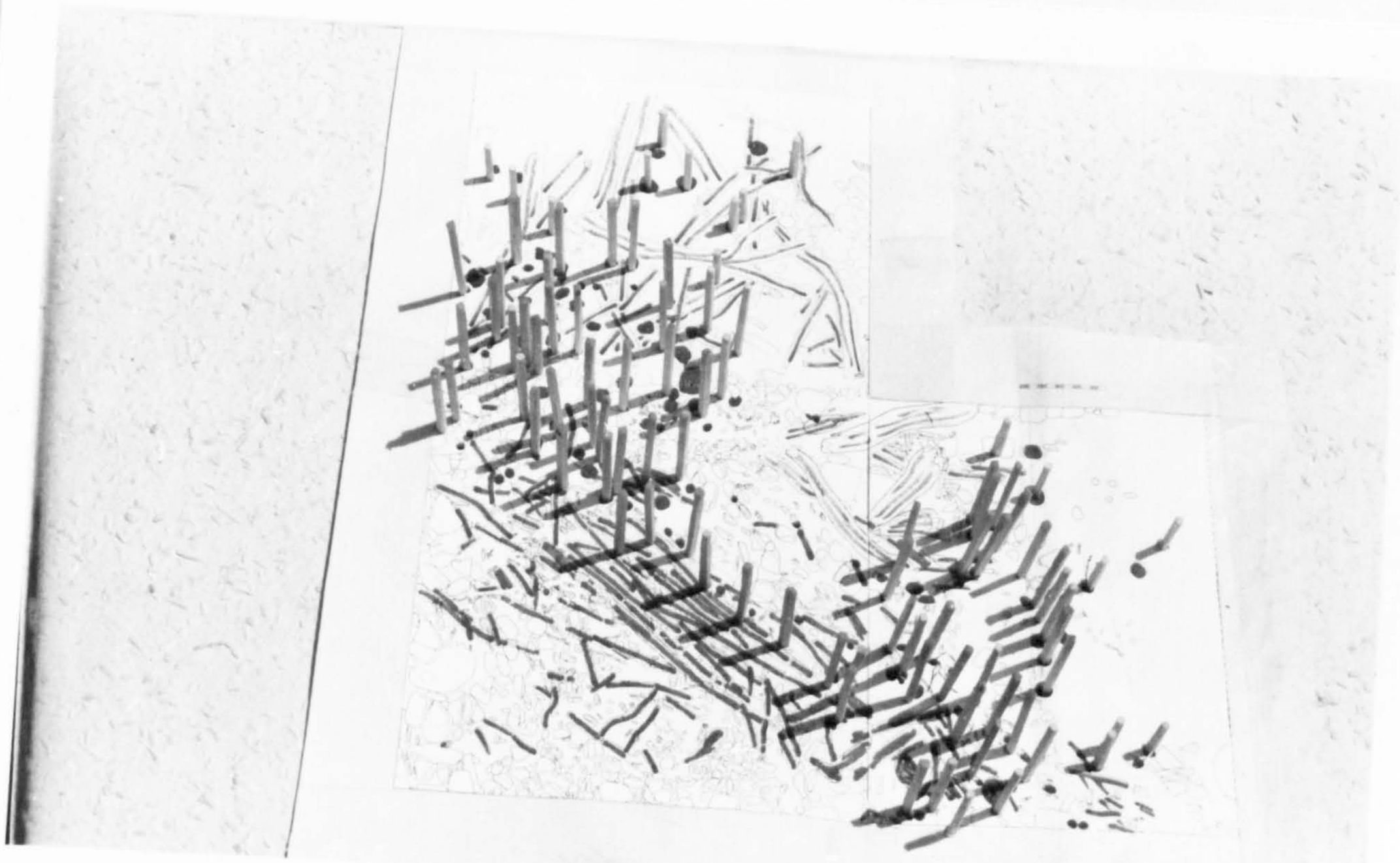


Plate 12a

Plate 12b



The reconstruction of the entrance with flanking walls, outside walkway supports, internal roof supports and a partition screening the floor area from the outside was only appreciated by examination of the model. Not all of the timbers indicated in it were necessarily contemporary, as had been shown above by the different levels of penetration of the site (see Chapter 10), but in many cases the later uprights were erected to strengthen weakened earlier ones thus establishing a contact between different chronological phases of occupation. The sequence of building and rebuilding on the crannog will eventually be established by dendrochronology or archaeological recording and the model will then be useful for demonstrating that sequence, by removal or insertion of the sticks. The same effect may be produced by computer but it may prove less visually realistic than the practical model.

7.6.9 Conclusion.

A number of methods of illustrating the crannog at Oakbank have been outlined above. Some are traditional and others less so, but all have been found useful to some degree in presenting the site as a whole, or in part, or in exhibiting certain aspects of the work being carried out there. They have not been covered here in great detail since they are still being assessed and adapted for use at Oakbank and on other crannogs in the future. Some are likely to become standard methods of visual presentation and others may prove too complicated or expensive to justify their continued use but this early stage of crannog excavations

underwater is the most appropriate time for consideration of them.

7.7 Finds Processing.

It should be remembered that any object, except inorganic material such as stones, will be only slightly negatively buoyant when excavated and unless it is contained will be transported easily by water movements too slight to be readily apparent. Therefore finds must be kept in enclosed containers, fastened down or taken directly to shore. All three methods are practised at Oakbank.

A great deal of material from the site cannot justifiably be treated as individual finds but is regarded as worthy of collection. This includes scattered burnt bone, some nuts and seeds, woodchips and undifferentiated debris. Each excavator has a weighted plastic container which contains large polythene bags labelled for different groups into which he places the unplanned finds. The selection is discretionary and may be questioned but is justified on the grounds that a final decision on acceptance or rejection of a particular object is best made in more relaxed conditions on shore.

This material is always a problem since the conservation facilities refuse to process undifferentiated material of this sort. However, unless some of it is kept it will not be represented in the final record of the site except on paper. A more objective method of random sampling is being envisaged, for material of this type, which will prove less arbitrary than at present when the larger, more obvious but possibly less representative examples are likely to be retained.

Text cut off in original

Artifacts whose position is to be recorded are placed in a plastic finds bag with a drafting-film tag on which is written the find's location, context and description. The bag is fastened with a plastic clothes peg to a plastic washing line attached to a plastic tray like those used by bakers for carrying bread. The tray may be kept underwater until it is full, when a deep area of the site is being worked and it is inconvenient to surface or when finds are prolific. If the area being worked is conveniently shallow, when the surface is calm or when finds are sparse the tray can be kept in the boat which is always on site. This also has the advantage that the boat tender whose hands are relatively dry and warm can write the label ensuring legibility. A finds position is plotted immediately by triangulation on two tapes attached to the corner control point of the appropriate area. All finds are kept wet until conservation or drying out is eventually decided upon.

Large finds (such as timbers presumed to be structural but with no marks of having been worked) are stored in a trench cut in the loch bed sediments near to shore and are covered by a heavy nylon net so that they do not travel in the currents during storms. They are not taken back for conservation but are left underwater for future research requirements. Similar timbers of a smaller size are stored in the same place in heavy duty plastic sacks.

Delicate finds or those of particular interest such as the plate, paddle, jet ring or stone bead found at Oakbank (see below) are treated as dictated by th position when found and are taken directly to shore when excavated. The plate, for instance, was in a number of very fragile pieces and was

lifted into a large square box so that each piece was not crushed. In the case of the paddle, it was lifted into a long, thin flower tray and embedded in sand to prevent movement before being taken to shore. Even so it broke at three ancient cracks when moved. An element of discretion is essential in handling such objects.

The observation and examination of finds underwater have advantages over land sites. Objects underwater are usually very clean when discovered with little material adhering to them. Since they have not been exposed to oxygen or light for a great deal of time when first exposed they retain their original freshness but regretably this fades very quickly and within half an hour the freshness of colour is faded to a dull grey. Since this freshness is never recovered there is a need for photography as soon after exposure as possible. The difference is clearly seen by a comparison of plate 7 and plate 8 which show the circular plate during and after excavation.

The ease of observation and examination and the freshness of newly exposed objects are strong arguments for detailed descriptions of artifacts being made at once. This is particularly appropriate when objects are going into a conservation process which may take a number of years, during which time the object is likely to undergo significant visual and structural changes. This aspect of excavation at Oakbank Crannog is undergoing reconsideration.

7.8 Summary.

It would have been inconceivable for archaeologists prior to the second half of the twentieth century to consider carrying out excavation underwater. The value of observations beneath the surface was appreciated by Blundell but the weight of the diving equipment and it's unwieldy nature in use prevented effective work.

Modern equipment and techniques of working underwater have removed many of the difficulties of early research and Scottish crannogs can now, for the first time, be examined at the convenience of the archaeologist and not only when they are exposed as a result of other work. Exploitation of these sites to the highest archaeological standards is now possible and the mass of important data which they contain is available for systematic research.

Chapter Eight.

Loch Tay Survey

8.1 Aims of the survey.

After examination of the historical sources and literature pertaining to the subject of crannogs in Scotland it was necessary to examine and consider material in the field for a fuller appreciation of the form and condition of the sites and their place in the landscape (and in the archaeological record as it stands at the present).

Accordingly, in the Spring of 1979 a survey was carried out in Loch Tay, Perthshire with six basic aims. Firstly, to locate and establish the number, position and form of crannogs in the loch and where possible to produce an elementary outline plan of each. Simultaneously, to examine each site for visible structural elements analogous with those observed and recorded in past work. Such elements would include, for example, remains of jetties, harbours, causeways, stepping stones, stone buildings and middens all of which are noted from crannog sites in Scotland.

The third basic aim was to establish the form of organic deposits and features, whether timbers, brushwood or less coherent deposits, for environmental examination and sampling with a view to constructing a relative chronological framework through landscape/ vegetation studies or absolute dating by tree-ring correlations or radiocarbon assay. The next aim was to investigate possible associations between individual sites and, where connections might be inferred, to examine the possibility of wider group contacts.

The fifth basic aim was to study the correlation of sites, or groups of sites, with topographical and geographical elements particularly in terms of agriculturally suitable land, and slopes/ heights/depths of shore and lochbed. The final and major aim was through study and assessment of all aspects of the survey to attempt to place Loch Tay crannogs as definable elements in the Scottish archaeological record and to consider the attributes of a site for future excavation.

8.2 The reasons for choosing Loch Tay for study.

Loch Tay was chosen for survey for a variety of reasons. A local history 'In Famed Breadalbane' (Gillies 1938) noted the position of five islands and seven submerged 'cairns' and made reference to an earlier legend that there were once twenty-four artificial islands in the loch (see below). Just prior to the 1979 survey a member of staff from Firbush Point, the outdoor centre of Edinburgh University on the south shore of the loch, supplied a recent record of a number of sites which he had observed. He marked their positions on a map of the area.

The existence of a number of sites in the loch permits comparisons of form and location and gives an overall picture of the range of sites that might be expected there and elsewhere. The records of Loch Tay indicated a wide range of sizes of site and a range of forms from large established islands to small submerged mounds. The proximity of sites to each other and their relationship to geographical features were also of interest.

Some work had already been carried out in the loch in the early seventies by Dr. and Mrs. McArdle who surveyed a number of the crannogs and Dr. I. Morrison had also surveyed sites in the loch. Their survey of Loch Awe in 1973 is the only comprehensive study of crannogs in a major

loch and the Loch Tay group was seen as useful for comparisons of the sites and of their setting in the landscape.

In practical terms the facilities and access to the sites were good. The small villages around the loch and the towns of Kenmore and Killin at either end supplied petrol and other sundries and accommodation was readily available in these places or at Firbush outdoor centre. The loch is not far from Edinburgh, on main roads for most of the journey, and boat access to the loch is available at a number of places around the shore.

8.3 Preliminary Work.

8.3.1 Maps.

Field survey of crannogs in any loch should be preceded by an examination of available reference material. Old maps may represent or emphasise islands or features presented with less consideration on later material. In the case of Loch Tay Mercator's atlas of Scotland produced from the late sixteenth century is notable. An edition probably from the early seventeenth century in the library of St. Andrews

University, showed the existence of three islands in Loch Tay. They were emphasised by a red symbol which, although no key is attached to the atlas, presumably represents a settlement of some sort according to the symbol's context elsewhere.

The three settlements are dispersed along the length of the loch and may represent Priory Island at the east end, Eilean nam Ereaban half-way up the loch off the north shore and Eilean Puttychan now a peninsula at the west end. These three sites are referred to in charters and tacks particularly from the sixteenth and seventeenth centuries when they were in the hands of the Campbells. These early references, with many also referring to other Scottish islands clearly point to occupation of natural and artificial islands in the mediaeval period. Presumably where such sites are marked on maps or referred to in early records they hold a significant position in the landscape of that time and other islands or crannogs, by omission, were se en as less important and therefore may already have been in a state of abandonment.

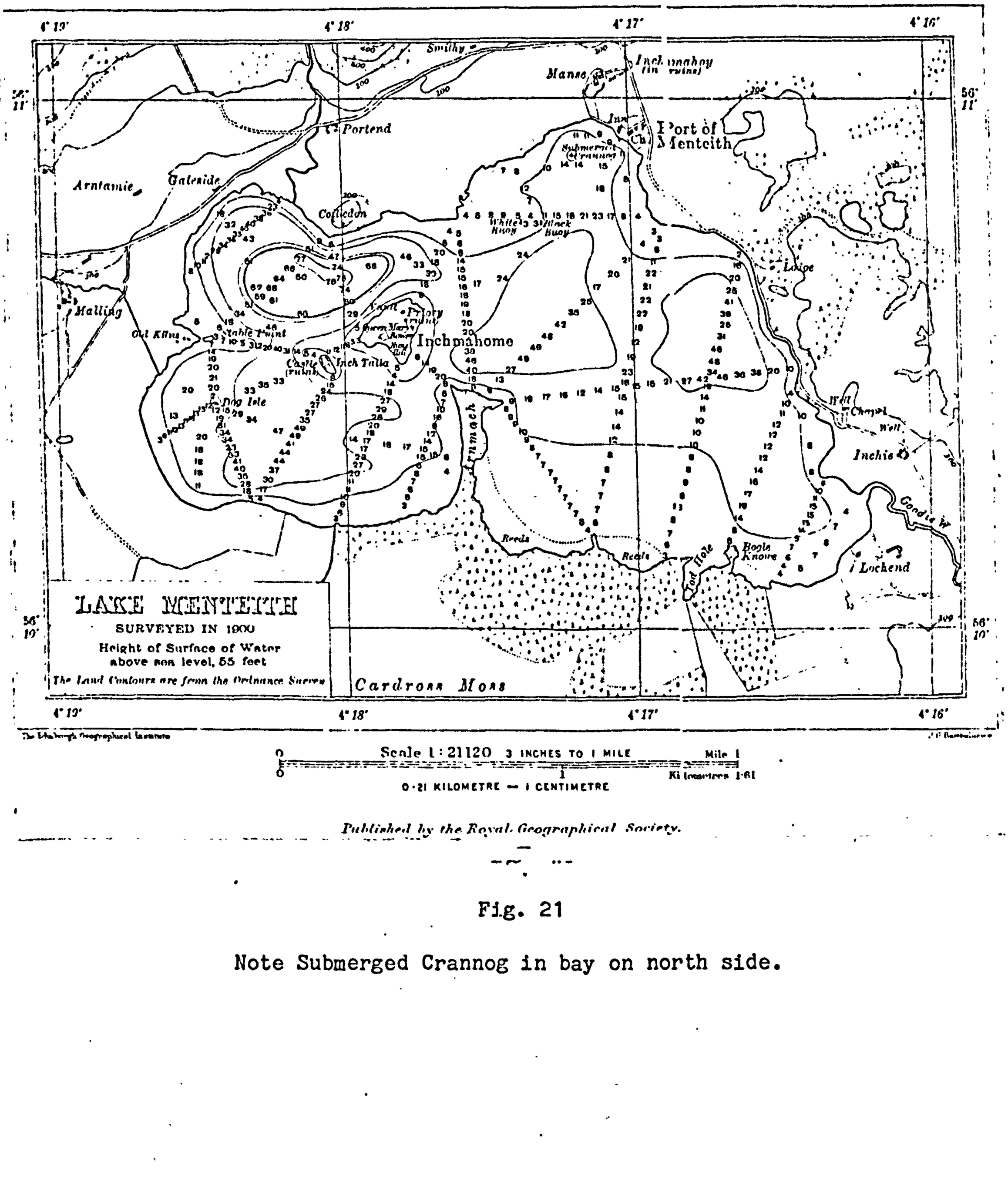
Later maps, where they indicate the existence of small islands in lochs, locate them more accurately than the early examples but not all islands are marked and in some cases the landscape has changed to such an extent that islands no longer exist. For example in Loch Tay the small island off the village of Acharn (no. 16 in App. A) is not marked on

the last edition of the OS 1" series and Eilean Puttychan, once an island at the west end of the loch is a small un-named peninsula on the 1" sheet, belying its mediaeval importance. An example of an island which to all intents and purposes no longer exists is the site of Keppoch's Council Isle, the artificial island excavated by Prof. Ritchie in 1933, now usually submerged beneath the waters of Loch Treig, which is obviously not marked on present OS maps of the area though an antiquity symbol indicates the position on the 1:10,000 series.

One of the most useful cartographic sources available when examining any aspect of Scottish lochs is the Bathymetrical Survey of Scottish Fresh Water Lochs by Murray and Pullar, published in 1910. They surveyed over 500 lochs and their results are represented in chart form with many depth measurements for each loch. In some cases they noted on the chart the position of submerged crannogs (fig. 21). The maps are useful field base maps at a scale of 3" to the mile. They are big enough to annotate yet small enough to handle in a boat or on the shore and the depth marks point to areas shallow and flat enough to support crannogs and those which are too deep and steeply sloping to do so. The appropriate chart of Loch Tay was used as the base map for the 1979 survey (Murray and Pullar 1910 III, pl. XXIV and XXV).

BATHYMETRICAL SURVEY OF THE SCOTTISH LOCHS.

BY SIR JOHN MURRAY, K.C.B., LL.D., F.R.S., AND FRED. P. PULLAR, F.R.G.S.



Published by the Royal Geographical Society.

Fig. 21

Note Submerged Crannog in bay on north side.

8.3.2 Local Histories and Records.

Local published histories and family papers are also a useful source of references to sites whose whereabouts, in some cases, have been passed down in lore and tradition. The Loch Tay region is particularly well-served in this respect as it was the main area of settlement firstly of the Campbells of Glenorchy and later the successive marquises of Breadalbane. The history of the House of Glenorchy was written in the first half of the seventeenth century by the family tutor and secretary, William Bowie. The Breadalbane Papers, now in Register House, Edinburgh, recorded many transactions, accounts and inventories and private letters of the Breadalbane family. In addition to these two collections are the chronicles of Fortingall covering the time from 1424 to 1579 written by the ministers of that village. The onerous task of collating and condensing these and other references to the Breadalbane district was carried out by the minister of Kenmore, William A. Gillies, and published under the title In Famed Breadalbane in 1938 and recently republished.

Gillies recorded of his own time:

> "Five of the artificial islands on Loch Tay are marked on the OS Map. There are several others that appear only when the water falls to a low level during a long summer drought" (Gillies 1938, 35).

When discussing Priory Island (1) he noted an earlier mention to

crannogs in the loch,

> "A tradition noted by Ewen MacDougall, a native of the district, over a hundred years ago, states that 'this island, with twenty-three more of lesser size, was built in the loch at the expense of King Alexander the First of Scotland'" (Gillies 1938, 35).

Although it is unlikely that Alexander I had Priory Island built it is in connection with the king that the island is first recorded. Reputedly Alexander's queen, Sybilla, died on 12 June 1122 on Priory Island, or the Island of Loch Tay as it was known then. The king, according to a charter signed at Stirling (the validity of which is in doubt), gave the island in perpetuity to the monks of Scone Abbey so that they could build a church there to the memory of Queen Sybilla (Gillies 1938, 36). Presumably it is from this event, or the record of it, that the name Priory Island comes though the RCAHMS points out that there is no evidence of an ecclesiastical building every having existed on the site. Whether or not Alexander I had any hand in the construction of islands in Loch Tay, or even knew of their artificial nature, Gillies considered Priory Island to be man-made as he pointed out,

> "From this charter it is clear that the Isle of Loch Tay was large enough in the twelfth century to be the site of a royal residence, or of a nunnery, yet it bears every indication of having been artificial in origin. Some forty years ago when the ruins upon the island were being repaired, the soil was examined to a considerable depth, and it was found to consist of

small stones and gravel which had evidently been deposited by human agency" (Gillies 1938, 36).

He wrote of four other islands still standing above the waters of the loch. Spry Island (17) in the shallow south-east corner of the loch opposite Kenmore appears as a substantial, well-established island with a cover of mature trees (pl. A8). This is a relatively modern impression as the island was enlarged and planted with trees for the visit of Queen Victoria to the district in 1842. Its appearance prior to that time is not known.

Of the island (16. Pl. A7) off the farm of Croftmartaig near Acharn on the south shore of the loch, Gillies could record little except that it is marked on Bleau's atlas. Of Eilean nam Breaban (6. Pl. A4) off the north shore of the loch he had more to record. He pointed out that it is sited on the end of a ledge of bedrock, the only site in Loch Tay where natural rock is evident in the foundation, and noted a line of stones on the west side of the site which may be the remains of a wall. These features were also reported in the 1979 survey. In 1526 the lands of Carwhin, of which the island is a part, were transferred from Haldane of Gleneagles to James Campbell of Lawers (Gillies 1938, 38) according to a charter of that date. It is mentioned in other charters of the sixteenth century and is marked on Bleau's Atlas. It is also assumed to be one of the sites marked as a settlement on Mercator's map of the early sixteenth century (see above).

The other site which he refers to as an island, Eilean Puttychan (10. Pl. A6) north of Killin at the west end of the loch, is in fact a peninsula now due to heavy silting at this end of the loch. Gillies records a tack of 1568 in which the seven markland of Morenish Wester, which includes the island, is let by Sir Colin Campbell of Glenorchy to Patrick Campbell of Glenlyon. The yearly rent was a sheaf of arrows 'if they be required' and the renter was permitted to build a stable on the shore adjacent to the island and could set six small nets in the loch beside the island (Gillies 1938, 38). A line of trees now leading from the site to the shore may be rooted in the remains of an earlier causeway (see plate A6).

Gillies also knew about seven 'large cairns' which were normally underwater, in fact he mentions eight sites in the text (Gillies 1938, 39). Although he referred to them as cairns he was aware of their real purpose,

> "It is probable that an examination of the sides would reveal the remains of the beams that supported the huts in which the lake-dwellers lived" (Gillies 1938, 39).

He accurately located sites 2, 3, 4, 5, 12, 14, 15 and 18 (see Appendix A). Number 18 is a confused mass of boulders in the position indicated by Gillies, fifty metres west of Kenmore pier, but it does not have the regular appearance of a crannog mound like the other sites in Loch Tay. It is possible that it represents a crannog which, due to its location, was a hazard to steamers approaching and leaving the pier at Kenmore and was

demolished for this reason. A search of early railway steamer records may clarify the situation.

Gillies did not make reference to five of the crannogs examined during the 1979 survey. In two cases, 11 and 13, this is not surprising since both of these sites are deeply submerged and not obviously visible. It is notable that he did not record the other three, 7-9, since they are quite visible and one, 7, is exposed when the loch level is low. It may be that he was more familiar with the east end of the loch since that is where his manse is situated.

Gillies intimated his acceptance of the proposed origin of the crannog builders, presented earlier by Munro (see above), as early Iron Age Celts with ultimately Continental lake-dwelling antecedents (Gillies 1938, 34, 40).

In Famed Breadalbane was a useful source of literary material relating to the crannogs in Loch Tay and reference to it prior to the field survey of 1979 saved time and effort. Similar histories and records are available for many parts of Scotland in many cases as family papers and records.

8.3.3 Modern Reports

Many Scottish lochs are exploited for various sports and pastimes. Most lochs are familiar to gillies, sailors and local fishermen, many of whom are aware of underwater obstructions. Crannog mounds are useful as places where trout may spawn but are a hazard to salmon and trout fishermen who trawl or cast from boats as their lines become entangled in the boulders. Therefore they have a vested interest in knowing the whereabouts of such hazards and are a good source of information for those trying to locate crannogs. In Loch Tay site number 5 was accurately pinpointed for the survey team by the gillie from Ardeonaig Hotel on the south shore of the loch.

Examination and notification of some of the Loch Tay crannogs were made by Mr. C. Cruickshank, a physical education instructor at Firbush Point, Edinburgh University's outdoor centre on the south shore of the loch, before 1979. During student sail-training, the keels of yachts occasionally came into contact with crannog mounds. To prevent damage and for his own interest Mr. Cruickshank noted the position of these sites, on a 1" OS map, and dived on some of them to establish their form. He communicated his findings to the survey team and personally pointed out many of the sites. In lochs where peaty water impairs visibility such local knowledge and practical assistance can save a great deal of search time and money in terms of petrol for outboard motors.

8.3.4 Aerial Photographs.

Another useful source of likely crannog locations are the aerial photographs held by institutions such as the SDA and the RCAHMS. The early photographs, back to 1948, taken by the RAF are of variable value. Since they were not taken for the specific purpose of showing up submerged features they may be of little use due to reflections on the water surface or because of wind generated waves. Where conditions were acceptable crannogs and other underwater features can be quite clearly seen.

Aerial photographs taken for archaeological purposes by the RCAHMS, University departments and Ancient Monument staff, unless specifically taken for the purpose of showing crannogs, suffer from the same problems as the RAF material. Also, in the course of safety most small fixed-wing aircraft, of the type normally used for archaeological work, stay away from large bodies of water particularly when they are bordered by steep shores and high mountains since there is nowhere to land in an emergency.

Notwithstanding these problems a study of the appropriate aerial photographs as a precursor to field survey offers a corpus of material for immediate investigation and the regularity of observed features may suggest an ordering of sites.

8.3.5 Field Search.

Small lochs may not require the use of a vessel but a practical search of a body of water the size of Loch Tay necessarily implies the use of a boat. Although some parts of the shore are accessible by road, the loch is over 22 kms. long and up to 1.5 kms. wide and most of the 25 kms. of shore is inaccessible due to the steep, rocky and overgrown countryside which borders it.

An Avon Searider rigid-hulled inflatable, loaned by the Geology Dept. of Edinburgh University, and a 28 hp Yamaha outboard engine were used for transport during the survey with support from a van on shore. This combination of boat and engine is fast yet stable, and is reasonably economical, and gave speedy access to all parts of the loch.

The team was accommodated at Firbush Point and the crannog situated off the point, no. 11, was a useful test of the intended survey methods before going further afield. Most of the crannogs were easily located using the information collected from maps, histories and local communications, as discussed above. The general area was quickly reached by boat and the site could usually be visually sighted either as an island or even as a low boulder area projecting slightly above the surface. Snorkelling or diving then established the form of the site as artificial or natural and planning could go ahead. After planning a further

underwater examination was made to establish the existence of stone features, timbers or other points of interest. The whole process from location to leaving the site usually took from 1 1/2 - 3 hours depending upon waves and weather. Very occasionally, in windy conditions, the work was postponed until the water was calmer.

Although twelve of the crannogs are completely submerged in winter when the loch level is high the survey took place in late spring when the water level had dropped and some of the sites were slightly exposed (2 and 7) or very close to the surface (8, 9 and 12). 2, 8, 9 and 12 were also marked with poles as they were in areas frequented by fishermen.

Seven of the sites are always underwater and their location could have been problematic. However five of them were pinpointed by local inhabitants (3, 4, 5, 11 and 15). The savings in time and effort afforded by their assistance were demonstrated by the difficulties encountered in locating numbers 13 and 14. These two sites are situated in a small bay off Dall Farm on the south shore of the loch and their existence was confirmed by the farmer. The sites in bays on either side, Craggan (12) and the Old Manse (15), had been located and planned but a number of runs across the bay at Dall Farm had not brought the two sites to light.

Eventually, by towing a diver underwater behind the boat the southern crannog (14) was discovered. Since the reference by the farmer to the possibility of another crannog in the bay had contained an element of speculation and Gillies had only mentioned the existence of one here it was concluded that another site already found had been implied. It was entirely fortuitous that while returning alone to Firbush after the planning of site 14 and travelling at considerable speed the author briefly discerned boulders beneath the surface. Upon examination site number 13 was discovered significantly deeper than site 14, which is a matter of some 250m away.

It is therefore possible that the survey in 1979 did not locate all of the crannog sites in Loch Tay though every likely area was visited. Sites may exist at depth which are not readily visible from the surface or on aerial photographs. Others may be buried in silt particularly at the west end of the loch where the depth of the water decreases annually due to heavy sediment inflow from the rivers Dochart and Lochay. A suggestion that more sites may exist comes from the comment attributed to Ewen MacDougall by Gillies,

> "this island, with twenty-three more of lesser size, was built in the loch at the expense of King Alexander the First of Scotland." (Gillies 193 8, 35).

The researchers in 1979 were of the opinion that all of the crannogs in the loch had been located but even if some have not those discovered must be close to the total number. The distribution as it stands displays at least one crannog in every bay with suitably shallow water and a flat bottom and occasionally as in the cases of 3 and 4, 13 and 14 and possibly 17 and 18 two sites in one bay. Contemporaniety is demonstrated in the case of 3 and 4 by radiocarbon dates (see App. H) and may apply in other cases such as 13 and 14 which are superficially similar.

The only way in which a practical search could be improved over the 1979 survey would be with the use of a helicopter for aerial observations when the loch is low, the water is calm and the sun is shining in the right direction to ensure maximum penetration through the water. The cost of such an operation may be inhibiting since the machine and personnel would have to be available for a considerable period of time but a less expensive method could employ the growing sport of parascending in which a person with a parachute is kept aloft by being towed behind a boat. The equipment required for this such as the boat and engine would also be appropriate for other work and the only extra expense would be the parachute. Also this method could be used in any loch survey. What seems revolutionary now will become accepted practise as requirements are recognised and techniques of fulfilling those requirements are developed.

8.4 Methods and Techniques

The methods and techniques used in the Loch Tay survey were based on a similar survey carried out in Loch Awe in 1973 by Drs. D. McArdle and I. Morrison of Edinburgh University and a team of divers supplied by the Naval Air Command Sub-Aqua Club. (D & E 1974 , PSAS in press, pers comm). The results of that survey were to establish the existence of twenty crannogs in Loch Awe, where three were estimated previously, and incidentally to lay down basic guidelines as to the principles of undertaking such a survey.

In Loch Tay actual survey recording was carried out using standard snorkelling gear consisting of a wet or dry suit to combat the extreme cold of the loch water, mask, snorkel and a weight belt with 16 pounds of lead to maintain stability. For observations and examination of the deeper parts of a site a single 2 cu. m. air cylinder and single-hose demand valve were utilised and in these cases assisted buoyancy life jackets were worn for added safety.

A high degree of accuracy was not considered essential at this level of survey and was balanced against the need for speed and general observation within the financial constraints and time scale of the project. Levels of accuracy of plus or minus 25 cms. in horizontal distances and plus or minus 10 cms. in depths and heights were accepted taking into consideration the

fact that the outline and height of sites are determined by the arbitrary laying of the covering boulders and that the position of the top edge of the side slopes was in some cases subjective. The above levels of accuracy relate to the accuracy of the measurements made and not to the final survey drawings of the site.

This level of accuracy meant that relatively simple surveying equipment could be used with a number of advantages. The equipment was cheap and easily acquired, not readily damaged and quickly replaceable if damage did occur. Most of the items were light and easy to handle, important considerations when the operators are already encumbered with diving equipment and working in a cold and difficult environment. The minimum of instruction was required and new operators achieved accuracy within the limits of the the equipment very quickly.

A team of three was sufficient to survey each site, two to operate the equipment and one to record the results. One operator was positioned towards the centre of the crannog with a 30 m tape attached to a belt round his waist. He was supplied with a Suunto sealed compass with which to take bearings. The second operator took the other end of the tape and was equipped with a surveyor's 5 m extending staff.

The second operator positioned the staff at salient points, for example the top of the side slope of the mound, and read off the depth, noted on the staff, and the distance from the first operator, marked on the tape. The first operator sighted the compass on the staff and read off the bearing. Obviously the person with the staff was required to carry out his tasks while floating in cases where the bottom was out of reach and he occasionally had to dive beneath the surface to ascertain that the base of the staff was in the correct position.

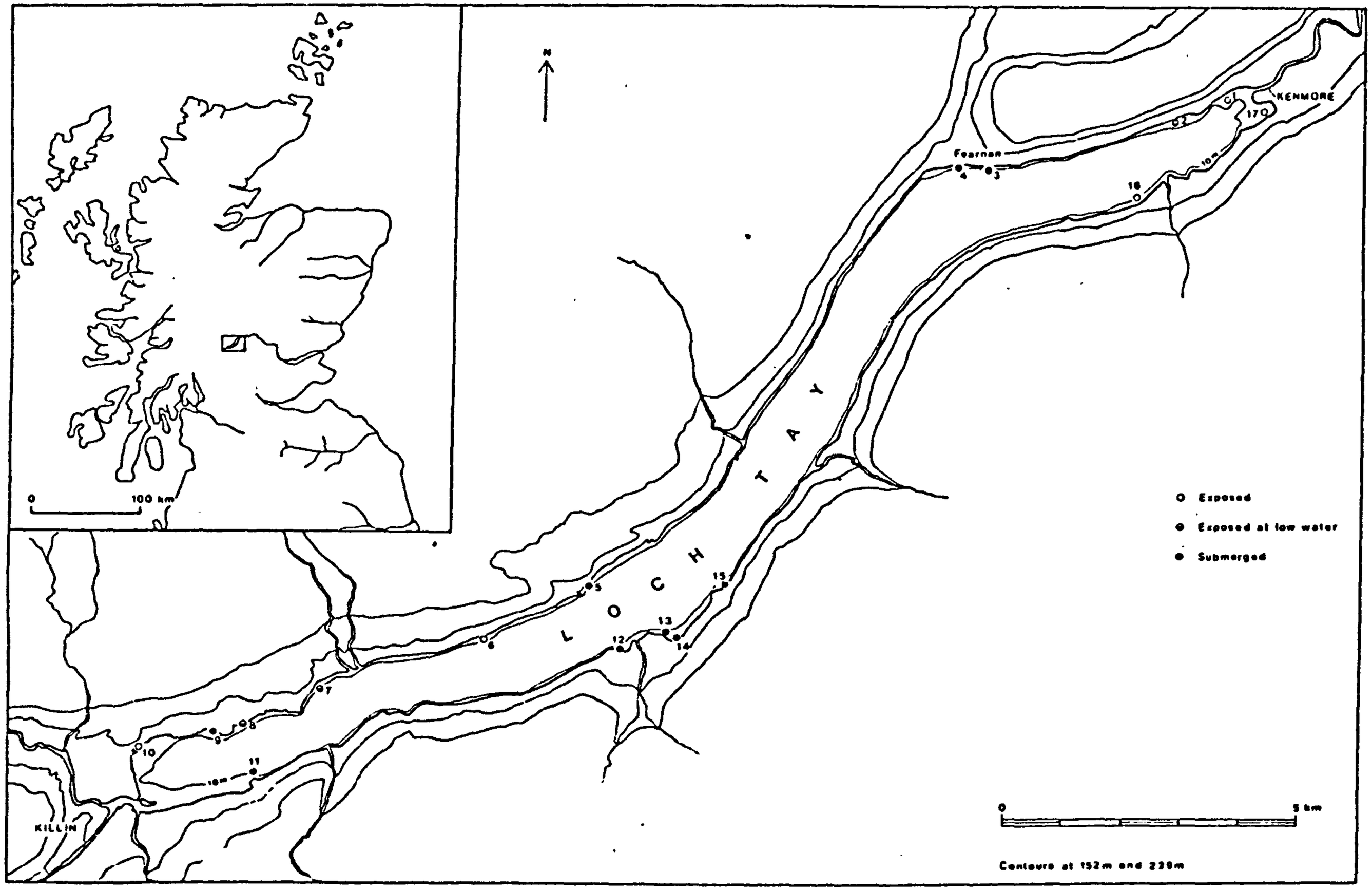
In calm conditions a site of about 30 m diameter could be recorded in around one and a half hours. However, when the water was choppy handling the staff was much more difficult, as waves tended to move it from the vertical, and the tape was billowed out by wind driven currents so that the recording operation took substantially longer.

Great care had to be taken to ensure that readings were enunciated loudly and clearly for the recorder particularly by the person handling the staff as in deeper water that person would often have to submerge his head to position the instrument. Also, as the staffman moved back to the furthest edges of the site he could be significantly further away from the recorder who was normally positioned near the bearing compass reader.

On two of the islands a theodolite was used instead of a bearing compass to try and gain greater accuracy, but overall the standard of accuracy was not much higher and the time taken to set up the instrument firmly on the boulder covered sites meant that the effort was not worthwhile. Particularly since the slowest link in the operation was the person operating the staff, so little time was saved anyway. Another factor militating against the theodolite was the danger of damage during a boat trip and the transfer to the site. If greater accuracy were required the use of an electronic distance recorder, such the Distomat, operated from shore would, in most cases, be feasible but it is doubtful if such accuracy would be of much benefit in recording this type of site at this stage.

8.5 Gazetteer - (see Appendix A).

Seventeen definite crannogs were located in the loch and planned (see distribution map). Of these, five are islands with the tops exposed above water level at all times and with established vegetation cover. Five are just exposed when the loch is at its lowest level in summer, although in three cases this may only be because the top of the crannog was built up in fairly modern times to support beacons for warning off boats. The remaining seven are all well submerged and unlikely to be exposed at the normal level of the loch.



Distribution Map of Crannogs in Loch Tay.

The names assigned to islands in the gazetteer are those used by the Ordnance Survey in their latest records. Submerged sites or those with no name are normally called after the nearest habitation on the shore. Popular names or those used in the past are included, but the modern nomenclature is in italics. The numbers before the name accord with those on the location map and plans and will be used when referring to specific sites in the text. Dates are those when the actual survey was carried out.

The average depth of the deepest points on each site is 3.7 m. and the average depth of the top areas of the submerged sites is 0.90 m. The average diameter of all seventeen sites is 28 m. remembering that some, eg 16 and 12, are irregularly shaped and the diameter is the mean of the longest and shortest axes.

Seven of the submerged sites exhibited exposed timbers ranging from one single beam with a mortice cut into the end projecting from site no. 7 to an array of three layers of substantial trunks projecting from the base of site 11 at loch bed level and extending for about 6m of the circumference. Four of these sites also showed evidence of organic deposits beneath boulders on the flat areas on top.

8.6 Consideration of the results of the survey

In the case of the sites which still stand above water level as permanent islands (1, 6, 10, 16, 17) only Eilean nam Breaban (6) shows evidence of having been sited on a bedrock foundation. A ridge of rock extends underwater to the west from the southwest corner of the exposed part of the site (pl A4). Although the ridge is not particularly extensive in area it may be inferred that bedrock is not deeply buried beneath the loch bed silts under the rest of the site.

Whether this location incorporating bedrock is deliberate or fortuitous is a matter of speculation as none of the other sites, either above or below water, display bedrock in their structures. Even in the case of Priory Island (1) where the remains of stone buildings still stand to a height of 15 m and where it might therefore have been assumed that a bedrock foundation would be necessary for support there is no indication of such being the case. This may be due to the remarkable firmness of the loch bed silts, which are able to withstand a substantial weight of material without distortion or it may be that bedrock is a part of some of the sites but that it is covered by the overlying material.

It is possible that some of these exposed islands might now have been completely submerged except for the fact that they were partly enlarged in a later secondary phase of building. Both Eilean nam Breaban (6) and Croftmartaig Island (16) have substantial underwater extensions which present a superficial impression of earlier phases of construction. Without the benefit of aerial photography these two sites appear to be small, sub-circular islands. However, an aerial view (pls. A4 and A7) shows the real dimensions with extensive areas beneath the surface and the impression that additions have been made to the west ends of both sites. Later occupation (mediaeval in the case of 6) overlying earlier construction, may be indicated in these cases but confirmation must await excavation.

On Eilean nam Breaban (6) a linear arrangement of boulders appears to be the remains of a stone structure of unknown function. It may represent the lower courses or foundations of a stone building or possibly the base of a breakwater to protect the island from the prevailing westerly waves. Stone features are also seen on some of the underwater sites. At the base of no. 7 on the loch bed at the southeast is a small area of boulders extending from the main mound. Since this is one of the deepest parts of the site, c. 4.5 m, and the extension is far too low to ever have reached the surface it may be merely slip from the steep- sloping side of the site or the stones may have been laid on an exposed timber feature which has subsequently rotted away.

On site 14 a band of smaller stones appears to cut off an area of the west end of the site now at a slightly lower level than the main mound to the east. Beneath and among the smaller stones were small pieces of wood and organic debris of indeterminate age.

A prominent, circular mound of stones lies on the west side of the crannog at Oakbank (3) and is joined to it by a narrow neck of boulders (see fig. 15). It is most likely that this extension is the remains of a landing stage or jetty as there is clear evidence of a timber superstructure seen in the eroded stumps of 40 piles in the loch bed around the periphery of the feature (see below Ch 10).

Seven of the sites displayed timbers of a definite or highly probable structural nature. Site 11, to the north of Firbush Point, exhibits an array of radial beams, the ends of which project from the base of the mound at loch bed level, (fig 22). There appear to be three layers with larger timbers, up to 0.50 m diameter on the bottom, overlain by two layers of smaller timbers c. 0.15 m in diameter. Bounding this array on the outside edge of the crannog are circumferentially laid branches, c. 0.05 m. diameter, with clear evidence of cutting with a sharp tool. The ends of the radial beams are exposed around the edge of the site for a distance of about 6 m. A sample was acquired from the basal layer of large timbers and produced a radiocarbon date of 199±60 bc (GU-1324).

Firbush Crannog, Loch Tay

basal timbers

oblique view

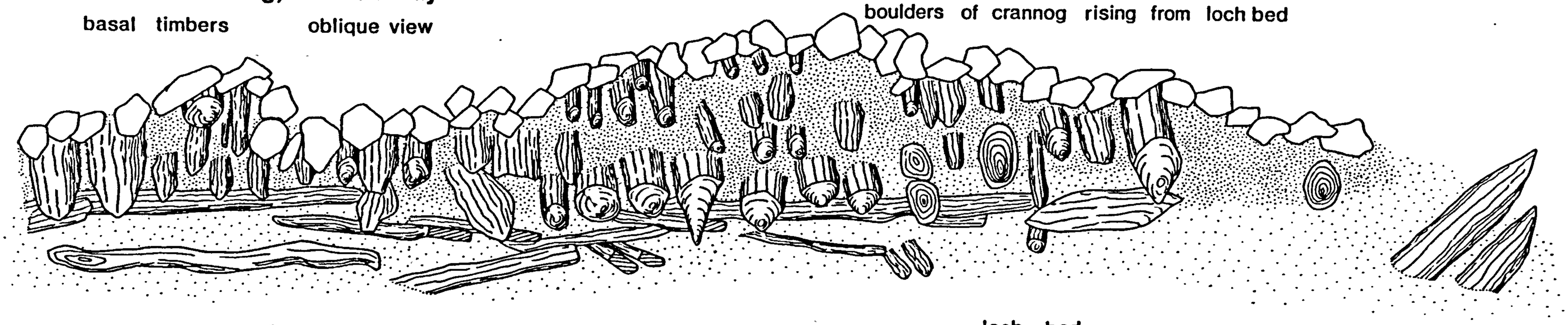


Fig. 22

A broad range of timbers were observed on the site at Oakbank (3) prior to the excavations described below. A number of substantial oak branches or trunks, apparently unworked, were embedded among the boulders on top of the mound. Nearby, a vertical oak pile stump (number 103 on site plan, fig 24) was sampled and a radiocarbon date of 595±55 bc (GU-1323. App. H) was obtained. From the loch bed in the angle between the main part of the site and the circular extension on the west, described above, another oak pile was sampled giving a radiocarbon date of 460±60 bc (GU-1325. App. H).

A slight ridge of stony gravel on the loch bed extends from the crannog to the shore. Projecting from the ridge are the stumps of 40 oak piles representing the remains of a gangway. Isolated timbers were observed at other places around the site and subsequent excavation has shown to some degree the extent of the structural framework (see Ch. 10).

Crannog 4, situated some 300 m to the west of 3, also displayed upright timbers projecting from the top of the mound. An oak pile was sampled and a radiocarbon date of 525±60 bc (GU-1322) was obtained from it. Nearby on the loch bed was a large beam with a mortice cut through it which probably came from the crannog but is not now directly associated with it.

Site 12, off the end of Craggan pier on the south shore of the loch is an elongated mound of stones aligned north - south. About half way along the top area projecting from an organic deposit which underlies the boulders are a number of oak timbers. The largest of these shows evidence of having been cut with a saw (pl 13) in two places.

Three pile stumps are peripheral to the south edge of no. 5 and a single morticed beam projects from the base of no. 7 close to the small stone extension described above. Some small timbers were discerned on the top of site no. 14 embedded in a substantial deposit of organic material including a scatter of burnt bone fragments.

Organic deposits were observed on five sites, 3, 4, 11, 12 and 14. The deposits were not disturbed during the survey of 1979 and only no. 3 has so far been examined by sampling and excavation (see below). A superficial study of the material on all of the sites showed it to be remarkably similar in each case. The major components were bracken, moss, leaves, twigs, nuts and seeds in a matrix of comminuted plant material. These components were in an excellent state of preservation and clearly identifiable. The most obvious seeds were hazelnuts, usually broken, and wild cherry stones, usually whole. In the case of site 14 a scatter of burnt bone was observed as part of the organic deposit. Detailed examination of the organic deposit in Oakbank Crannog (3) took place during excavation (see below).

Plate 13

There the deposition of the layers was seen to be an almost wholly artificial process with them probably being laid as bedding or flooring material.

The sites appear as flat-topped, steep-sided stone mounds and the superficial similarity of appearance is emphasised by a fine coating of grey algae covering the stones, timbers and other features of the sites. When the algae is cleaned off timbers and other features become more apparent.

8.7 Relationship between Loch Tay Crannogs and Shore Sites.

The crannogs in Loch Tay form a group of sites in a closely delimited geographical setting. However some may feel that the siting in water is a fortuitous connection and that the crannogs in the loch may be more closely associated with sites on land than with each other (though it is highly unlikely that sites inhabited contemporaneously and in clear line of site would not have some form of contact). A number of sites have been recognised in the area but in no case is there established either physical or temporal association with crannogs.

Cup-marked rocks are reported close to a number of the crannogs. For instance on the hillside north of 7 and 5 there are a number of such rocks and south of 16 on the opposite shore of the loch. A fort is recorded on a natural island in the River

Dochart at Killin. A standing stone is found on the shore between 9 and 10 and stone circles are sited on the heights south of 16, at the village of Lawers on the north shore and near Killin at the west end of the loch. A variety of sites including cup-marked rocks, standing stones, bronze-age cists, cairns, a hut circle and a ring fort are found in the vicinity of the village of Fortingall two miles north of Fearnan and sites 3 and 4. Stone axes were found on the north shore of the loch not far east of 5 and a dark age burial ground is recorded nearby.

The closest recorded relationship between a crannog and a site on shore is that of the foundation of a thick wall cutting off the peninsula at Firbush Point on the shore adjacent to site 11. The site of an 'ancient castramentation' is marked here on the atlas of 1769 but nothing is visible now and any evidence was probably destroyed with the building of the harbour on the point at the end of the nineteenth century (OS card NN63 SW2).

Most of the sites recorded around Loch Tay would normally be assigned to the Bronze Age and although some are not far from crannogs many are found in other areas. There is no significant correlation between the two groups as yet.

Undoubtedly structures were built on shore by the crannog dwellers as stores, workshops and stock houses or enclosures. In some cases there is doubt that a crannog was large enough to be a dwelling (for instance 8 and 9) and may instead have been a store or animal refuge with the main house on shore.

Shore structures if timber-built would not survive. Since the crannogs are sited close to agricultural land and shore extensions would have been built on that land they would be destroyed by subsequent cultivation. However, no effort has been made to recognise the remains of stone structures and a survey for that purpose would be useful particularly since many of the shores adjacent to crannogs are backed by sloping land. Erosion and land slip may have protected earlier structures or even land surfaces with evidence of ploughing. Trial excavation may disclose the level of preservation, if any, of stone features.

8.8 Topography.

Study of the land and underwater contours of Loch Tay and their relationship to the crannogs in the loch show certain close correlations. On fig. 23 the 122 m. contour has been emphasised and the area between that contour and the loch shore has been shaded. The loch surface is at an average height of about 106 m. OD so the distance from the shore to the 122 m. contour represents a rise of about 15 m. Therefore, the shaded area on the map indicates the slope of the land around the loch. The wider the shaded area the less steep is the slope and accordingly the more susceptible is that land to agricultural land use.

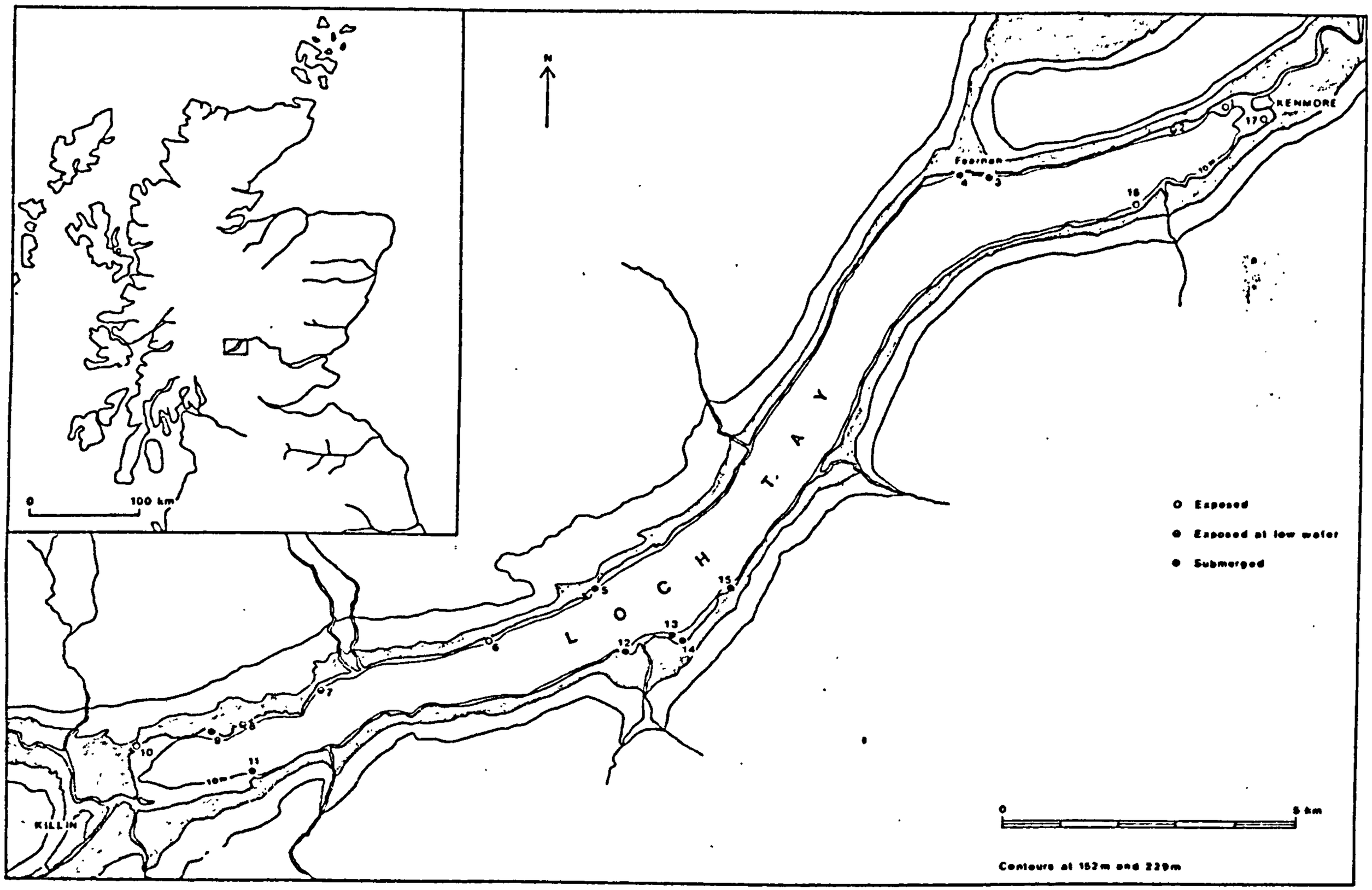

N
0
100 km
FEARNAN
RENMORE
170
10m
15
0
L O C H
T A Y
5
15
13
12
14
7
8
9
10
11
10m
KILLIN
Exposed
Exposed at low water
Submerged
0
5 km
Contours at 152m and 229m

Fig. 23

The positions of most of the crannogs in Loch Tay clearly correspond to areas of lesser slope and it may be inferred from this that suitable land for cultivation was a major factor influencing the choice of site for the crannog builders.

Of the seventeen sites in Loch Tay all but one (6) are close to substantial areas of land under cultivation at present. Numbers 16, 17, 1, 2 and 18 could take advantage of the alluvial deposits at the east end of the loch which would support a large number of animals in pasture and a broad area of land for cultivation.

The same applies to the west end of the loch where sites 7 - 10 and possibly 11 are well sited to utilise the alluvial deposits from the Rivers Dochart and Lochay. At this end of the loch there is less readily cultivable land which is not liable to flooding in the Winter but the routes up the valleys of the Dochart and Lochay would offer abundant grazing for stock.

Sites 3 and 4 are situated at a point on the north shore where silt has built up due to the currents driven by the westerly winds and the same can be said of the land adjacent to sites 12 - 15. The formation of the latter has been enlarged by the alluvial outflow of the Ardeonaig Burn and Allt A Mhein and the numerous small burns between them.

The inhabitants of site 5 may have taken advantage of the small alluvial fans of the Allt a' Choire Chireinich, which flows into the loch at Balnahanaid, and the Allt Choire a Chonnaid'h, which debouches to the west of the site. Good grazing is also available further up the hillside in the area occupied by the modern farms of Tombreck, Craggantoll, Cragganester and Balnasuim.

The only site which does not apparently have access to cultivable land is Eilean nam Breaban (6) situated off the north shore of the loch between sites 5 and 7 which inhabit the closest cultivable land on the shore. However, cultivable land is to be found not far to the north between the modern farms of Croftvellich and Kiltyrie above the 213 m. contour and below the modern road.

Whether these higher pastures were cultivated in earlier periods or not is a matter of speculation and a clear agricultural association between them and the nearest crannogs can only be established through excavation, or at least sampling, of the appropriate site. The excavations at Oakbank Crannog (3) (see below) show a significant commitment to both stock raising and arable agriculture in the sixth century bc and possibly earlier.

An area of cultivable land, according to the above observations, was a desirable factor in the siting of all but one of the crannogs in Loch Tay but an essential factor in location was the availability of a suitable flat area of loch bed on which to build the structure. Such an area required to be in water deep enough to offer protection and shallow enough to work in and construct a solid structure. In most cases 3 - 5 m appears to have been a desirable depth of loch bed. In some cases, eg 8 and 10, where the bottom depth is much shallower this may be due to subsequent silting since construction took place.

A steeply sloping loch bottom would not apparently be conducive to solid foundations and the majority of the Loch Tay crannogs are built on flat, or gently sloping, areas of the loch bed. Two sites however (nos. 2 and 9) now seem to be on considerable slopes. It is possible that later silting has had a considerable effect in the vicinity of these two examples.

The aims of the Loch Tay survey, the preliminary work and the methods and techniques employed have been outlined above. The range in size and form of the crannogs has been covered as has their relationship to sites on the shore and their requirements in terms of the topography of the land and the loch bed. A comparison of the sites in Loch Tay with those in Loch Awe is made in the following chapter.

Chapter Nine

Comparison of Loch Awe and Loch Tay Groups

9.1 General Dimensions.

Two lochs containing groups of crannogs have now been surveyed. Loch Awe was surveyed in 1973 (see above) and Loch Tay in 1979. Twenty crannogs were recognised in Loch Awe out of sixty sites which were examined and seventeen definite artificial islands were established in Loch Tay with the likelihood of one other, 18, which has been demolished. The two groups have many similarities of construction and distribution but a number of differences are also apparent.

In general terms the groups are similar with more obvious distinctions between the sites in each loch than between the groups themselves. The smallest crannogs in each case are comparable. Number 8 in Loch Tay has an overall diameter of 10m and number 12 in Loch Awe is 13.5m diameter. The usable area in both cases is about 15 square metres and they stand only 50cm off the loch bed. They are close to the shore and can be approached by wading although the water surrounding them may have been

deeper in the past. Whether such small platforms would have been used as dwelling places is a matter of conjecture but excavation may disclose their original functions.

By far the largest of the thirty-seven sites is Priory Island in Loch Tay which still has ruins of a stone building standing to a height of c. 15m. Joined to the building are the remains of a wall which enclosed a courtyard c. 800 square metres in area. The island is well-documented as the main stronghold of the Campbells of Glenorchy (Gillies 1938) for many years. Its construction is attributed to Alexander I of Scotland though there is doubt about the documentary evidence which supports this suggestion.

Underwater examination of the lower portion of the site points to artificial construction or artificial enlargement sufficient to obscure any underlying bedrock. The boulders which create at least a superficial cover to the site are similar in size and appearance to those which cover the other crannogs in the loch. Clearly the island involved a substantial commitment in labour, time and material, whatever period it was built in.

As a dwelling site in the late mediaeval period Priory Island was large enough to be the eastern stronghold for the Campbells of Glenorchy, later the earldom of Breadalbane and eventually the largest estate in Britain (Gillies 1938, Ch. IX). Presumably in earlier times it was also inhabited by prominent members of the community and the builder, if it was not

Alexander I, must have commanded substantial powers or obligations to carry out such a task. It is possible that the original island was smaller than it now stands and that subsequent additions brought it to its present size, but if so it is not evident by observation.

None of the crannogs in Loch Awe approach Priory Island in size but this is not surprising since few sites like it are found elsewhere in Scotland. It is probable in the case of Loch Awe that large crannogs were not built as there are a number of large natural islands which may have been inhabited in prehistory and certainly were in later times as in the cases of Kilchurn Castle at the north-east end of the loch, the castle on Innis Chonnell half-way down on the south shore and the nearby chapel on Innis Sea-rainhach. The same situation, making large crannogs unnecessary, may also be observed in other Scottish lochs.

In Loch Tay, Eilean nam Breaban (6), Eilean Puttychan (10), Croftmartaig Island (16) and Spar Island (17) are all substantial sites. This however may not always have been the case. Numbers 6 and 16 demonstrate two clearly distinct levels, one above and one below water level, which may suggest later additions to the original structure. Number 17 is known to have been enlarged and landscaped during the nineteenth century (see above).

A number of large sites in Loch Awe (2, 3, 5, 16 and 20) are comparable in size to the above Loch Tay crannogs. It is notable that all of these large Loch Awe sites ae based on bedrock foundations while only one site, number 6, in Loch Tay displays any evidence of bedrock. In fact, fourteen, 70 percent, of the crannogs in Loch Awe take advantage of bedrock or natural mounds on the loch bed suggesting that such features were deliberately chosen. In Loch Tay there was no choice as there are no obvious natural mounds and few exposures of bedrock but clearly this in no way inhibited the building of crannogs.

The overall size of the above sites implies the utilisation of large amounts of labour and materials. It is therefore remarkable that in some cases the flat useful area available on the top of the mound is disproportionately small. Indeed some sites with smaller overall dimensions in both lochs offer a larger useful area. For instance numbers 2, 3, 5, and 16 in Loch Awe are large sites with useful areas of less than 17m diameter and site 10 in Loch Tay offers an area of only 10m x 5m. In contrast numbers 2, 3, and 5 in Loch Awe and 2 and 4 in Loch Tay though smaller overall offer areas for utilisation of 20m or more in diameter.

A rough breakdown of useful area sizes shows that fourteen sites have diameters of 11m or less available and only four of these have less than 7m. Twelve sites range between 13m and 18m with seven Loch Awe sites from 13m-17m and five Loch Tay sites

from 15m-18m. Four sites from each loch have useful diameters of 20m-22m and two Loch Tay crannogs have 30m or more available. Except for the two latter sites the distribution of sites from each loch is similar throughout the size ranges. In terms of overall diameters all except five of the sites from both lochs are evenly distributed from 10m-35m. Four of the exceptions are more than 41m in diameter and one is less than 10m.

In the above comparisons 'diameter' relates to the mean of the longest and shortest axes where a site is not at least roughly circular. Whether these figures are meaningful is questionable since the dimensions of crannog mounds as they now appear in the landscape may not closely relate to what was considered as functional when they were inhabited. The purpose of the boulders which now cover the majority of the sites is not yet known (see below Chapter Ten) and they may not represent living or working floors. Also they may distort or mask the dimensions of earlier floors or structures which they overlie.

Although the distinction between the crannog mound and the surrounding loch bed is obvious, except where mud or silt has built-up around the site, the difference between the sloping sides of the mound and the break of slope onto the flatter top is not usually clear and requires a subjective decision on the part of the surveyors. Recognition of features among the boulders of the crannogs is also often subjective and this may be represented in the following descriptions of features observed from both groups. It may be useful to form a set of guidelines and

possibly feature definitions based on the results of the Loch Awe and Loch Tay surveys to enable future surveyors to work within an agreed systematic framework.

9.2 Timber Features.

Timbers were observed on sixteen of the thirty-seven sites, nine in Loch Awe and seven in Loch Tay. In most cases they were recognised as oak. This does not mean that oak is the most common sort of wood used but that it is the best preserved in exposed conditions. At Oakbank crannog in Loch Tay oak timbers were observed prior to excavation but alder was the most common species recognised during excavation.

Various types of worked wood were associated with sites in both lochs. Timbers with square mortices cut through them were lying exposed beside number 20 in Loch Awe and number 4 in Loch Tay. These timbers may be of suspect provenance since they were close to but not attached to crannogs, though a similar piece of working is seen on a timber projecting from the base of number 7 in Loch Tay.

Radial arrangements of timbers were found on numbers 13, 16 and 20 in Loch Awe and the ends of radially aligned timbers were observed projecting from the base of site 11 in Loch Tay. This array is exposed for c. 6m around the bottom edge of the site

(fig. 22). Notched timbers were evident on Loch Awe 20 and Loch Tay 3 and structural beams at right angles to each other and with a half-check cut from one of them were seen on the top of Loch Awe 6. On the top of Loch Tay 12 oak timbers were observed projecting from an organic deposit and displaying in one case clear evidence of cutting with a saw (pl. 13).

Piles are exhibited at only one of the Loch Awe sites, 15, where four were said to be supporting the stone facing of the mound on a steep slope, while five sites in Loch Tay (3, 4, 5, 12 and 14) displayed uprights. An organic deposit was seen at Loch Awe 5 where a stratified midden lay on the loch bed in the angle formed by the crannog and the glacial mound on which it is built. Timbers, one with a half-check cut from it, were observed in the midden. Other deposits were seen on sites 3, 4, 11, 12 and 14 in Loch Tay. In all except 11, the deposits were on the top of the crannog beneath the layer of boulders and in every case timbers were embedded in the material. Excavation of Oakbank crannog, 3, (see below) is helping to clarify the composition and method of laying down of these deposits.

9.3 Stone Features.

The Loch Awe group as a whole displays more stone structural features than the sites in Loch Tay. Harbours and jetties which are often recorded from crannogs in Scotland are hardly represented in Loch Tay. Priory Island has a number of small stone jetties which may have been constructed at any period and are not major elements of the sites. A small mound appended to the west end of Oakbank Crannog is construed as the remains of a jetty and there is clear evidence of a timber superstructure in the form of forty pile stumps surrounding it. The size and complexity of this feature (see below) make it a major component of the site but it is the only one of its type in the loch. The underwater areas of sites 6 and 16 may have acted as landing places but they do not possess the form of jétties or harbours seen elsewhere.

Sites 2, 8, 14, 19 and 20 in Loch Awe all show features which may be harbours. The most obvious are on 8 and 19 where arms or breakwaters enclose areas of water. The same type of formation is well-documented at Milton Loch Crannog I (Piggott 1953, figure 2). Jetties were seen at 7, 11, 13 and 15 in Loch Awe and causeways which are also recorded from many sites throughout Scotland were observed at numbers 1, 2, 12 and 17, and less positively at 4 and 14. In Loch Tay the only certainly man-made gangway is that which joined Oakbank Crannog to the shore though this was not a stone feature and is represented by

the stumps of forty oak piles (see below). Site 10 is now joined to the shore of Loch Tay as a peninsula and a causeway may have been a part of this site in the past.

The harbour bases on Loch Awe 8 and 19 were surfaced with stone chippings which were also recognised at 1, 4, 13 and 16. These were seen by the surveyors as providing easier footing when getting onto the crannog from a boat or for animals which had been swum out to the site. A similar area was observed at Loch Tay 15 but was deep underwater and well below the level of the main part of the mound. Its function is unknown.

Excepting the substantial remains of stone walls and buildings on Priory Island only one insubstantial line of stones on Eilean nam Breaban (6) indicates the remains of stone features on the Loch Tay sites. Whether this is the line of a house wall or breakwater is not clear from superficial observation. In Loch Awe an arrangement of stones ending in a right-angled corner was seen on 14 and a square stone setting overlying timbers was recorded on 13. A two-course circular formation interpreted as a hearth was seen on number 17 and stones set on edge were noted on 20 and 14.

The diameters of the Loch Awe and Loch Tay crannogs do not imply value judgements except possibly in terms of Priory Island. The size of a site cannot be considered as an indication of the function of that site or the importance of the inhabitants in their community. Large sites may have been used for storage

or for stock housing while smaller sites may have been places of specialised functions such as metalworking. Sites like number 9 in Loch Tay although offering a small top area would have required as much effort and labour to build as those with more space on top but in shallower water. Such commitment does not suggest that crannogs like number 9 are of less importance than more imposing islands. Until excavation has shown the full range of functions carried out on crannogs and whether they correlate with size or shape it is of little significance to compare them with each other in terms of area. An indication of the activities carried on on Oakbank crannog is given in Chapter 11.

The site which offers the most complete outline of a crannog dwelling is Milton Loch Crannog I which, according to the excavator's plans, was about 15m across (Piggott 1953, 140). Lochlee Crannog excavated in 1878 appears to have had a living area 10 m - 15 m across (fig. 6) and Buston Crannog excavated in 1880 according to the plans provided an area less than 10 m in diameter (fig. 7) though it is difficult to assess the position of the house walls.

The house plan on Oakbank Crannog has not yet been fully exposed but if the curves of the walls flanking the entrance are accurately portrayed (fig. 25) an ultimate diameter of c. 15 m may be expected. This leaves a substantial area around the outside of the house and particularly over the putative jetty the purpose of which is not yet established. Also it is possible that the earlier phase of the site preceded the extension on the

west and may have been smaller than the boulder layer now suggests, though it should be noted that substantial piles are found to the outside edge of the boulders in area E (fig. 25) indicating that the earlier phases may have been as wide as the later.

Clearly the comparison of crannog habitation area sizes based only on evidence of survey is highly speculative since the mounds as they now stand may not be representative of their earlier form. Later additions and modification may have substantially altered their sizes and clearer correlation must await excavation. Nevertheless it is clear that they were in many cases large dwellings compared to other prehistoric homesteads and even the smaller crannogs are not particularly small when compared to round-houses on land.

Large sites like Priory Island are not common but are found elsewhere and if they were constructed and inhabited prior to the mediaeval period they may supply important information about the way of life of powerful figures in the community. Evidence which suggests that these large sites may not be very different in their original form of construction from the smaller examples was suggested by the excavation of the island in the Loch of Kinellan despite the difficulties and deficiencies of the work. The timber origins of the site were recorded by the excavator: "In all the pits wood was encountered at a depth of from three to four feet" (Fraser 1915, 231). Since eleven pits were dug in all parts of the island it may be assumed that the original site was

a large timber structure. At 60m x 40 m in size this island is comparable with Priory Island and in the mediaeval period it was the hunting seat of the Earls of Ross. Excavation of sites of this type would be expensive and complex, particularly since the air/water interface would have to be worked through, but the results could prove invaluable to the archaeological record of prehistoric Scotland.

The problems encountered by earlier researchers working on essentially waterlogged sites have been discussed above in Chapter 5. The indications which they gave to substantial sites with well-preserved organic remains have been confirmed by the surveys carried out in Loch Awe and Loch Tay. The results of these surveys suggest that a great deal of useful data may be derived from crannogs excavated with the advantages of modern archaeological methods and techniques and Chapters 10 and 11 cover the partial excavation of Oakbank crannog in Loch Tay. The excavation was carried out underwater to minimise the problems discussed above regarding drained sites and the results of the excavation demonstrate the potential of this kind of work.

Chapter Ten

Oakbank Crannog, Loch Tay: Excavation.

Part 1. Stratigraphy and Structure.

10.1 Oakbank Crannog: Background.

A crannog off the cottage of Oakbank in the village of Fearnan, four and a half miles from Kenmore, on the north shore of Loch Tay was chosen for excavation (pl 14). There were a number of good reasons for choosing this site, some archaeological and some practical.

Superficially the crannog appears to be a mound of boulders (pl 15) rising from a flat, light-coloured, sandy loch bed which slopes slightly down from north to south. That is away from the shore. The depth of water above the loch bed on the north side of the site varies between 2 m in summer and 3 - 3.5 m in winter. On the south side, furthest from the shore, it varies between 4 m and 5 - 5.5 m. The crannog mound stands about 1.5 m proud of the loch bed nearest the shore and about 3 m high on the offshore side.

Plate 14

Plate 15

Archaeologically the site showed a great deal of potential. In plan (fig. 15) it is roughly pear-shaped with the narrow end to the west and the wide end to the east. Adjoining the west end is a sub-circular extension with the superficial appearance of a low mound of boulders resembling a very small, almost independent, crannog. The top of the small mound is considerably lower, and therefore deeper underwater, than the top of the main mound suggesting that it was not a living platform in the same manner as the crannog proper.

The two mounds are joined with a narrow neck of large boulders 3 - 4m wide and the loch bed on the north or landward side of the neck was almost 1m higher than on the south side because of silt build-up. On the south-east edge of the extension were four evenly-spaced pile stumps of a softish wood and a number of horizontal timbers of the same wood interspersed haphazardly among them. Near the edge of the crannog but close to the other timbers was the stump of an oak pile embedded in the loch bed. This was sampled and gave a radiocarbon date of 460+60bc (GU-1325). Later examination showed that the evenly- aced soft wood piles were only part of an arrangement of 40 piles which surrounded the extension.

Leading from the north edge of the main site northward to the shallows which border the shore is a low ridge on the loch bed. Along the length of this ridge and projecting from it are the stumps of 40 oak piles. They are still firmly set into the

material of the ridge and some horizontal timbers were observed projecting from beneath the crannog at the south end of the ridge and from the boulders in the shallows at the north end. Clearly these are the remains of a causeway from the crannog to the shore.

On the top of the crannog around control point Y (fig. 24) a number of irregular oak timbers were observed. They were firmly embedded below the layer of large boulders which dominated the superficial appearance of the site. There was no evidence of tool marks or shaping and the sapwood had been eroded away leaving very hard heartwood. Nearby were the tops of two piles. One was of oak and the other of a different type of wood. The larger oak pile (103, fig 24) was sampled for radiocarbon dating and eventually produced a date of 595+55bc (GU 1323). No movement could be felt in either of these timbers. Around the base of the radiocarbon dated sample a deposit of organic material was observed and a preliminary examination for pollen showed cereal, grass and a wide variety of well-preserved seed types.

Some smaller soft wood piles and horizontal timbers were observed in and on the loch bed at the wide east end of the crannog and a nearby oak stump has a half check cut into it at loch bed level. It is not clear whether this stump is in situ or has fallen from higher up. If it is in situ it may offer important information regarding the formation of the foundation framework. It is hoped to excavate this area in a future season.

OAKBANK CRANNOG

Plan Areas B, D and E

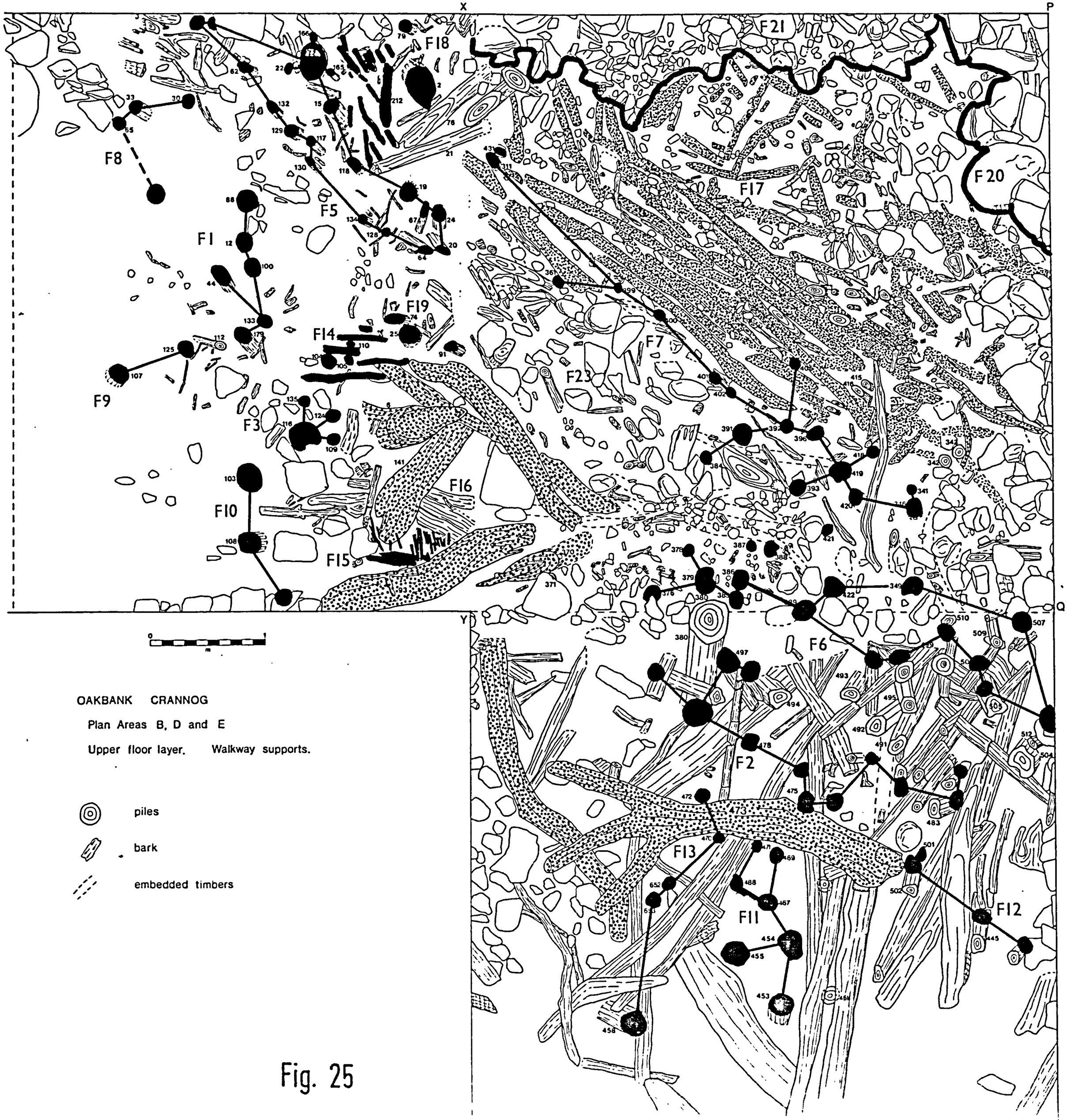
Upper floor layer. Walkway supports.

piles

bark

embedded timbers

Fig. 24



OAKBANK CRANNOG

Plan Areas B, D and E

Upper floor layer. Walkway supports.

piles

bark

embedded timbers

Fig. 25

On the north-west edge of the crannog at loch bed level and projecting from the mass of the mound were a number of horizontal timbers. They appear flattened but it is not yet possible to state firmly whether they have been cut that way or eroded. Initial examination suggests erosion as most likely. In close association with these timbers were a number of soft wood piles and a thin deposit of organic remains consisting of hazelnut shells, small seeds and dograded bone including bovine teeth. It is possible that these features are part of a habitation deposit. If this is the case the low level would suggest that it belongs to an early phase of the site's history. Clarification must await excavation in this area.

The above features were all obvious prior to excavation except for the piles surrounding the extension. The tops of these were exposed later by removing a layer of loch bed silt some 5 cms thick. None of the timbers except the two radiocarbon samples were removed or cut before excavation and in the case of these two the top of the stumps were removed leaving the rest of the pile in situ.

The substantial amounts of organic material in the form of timbers and vegetable debris along with the well-defined morphological structures of the crannog, extension and causeway are not all found on the other sites in Loch Tay. Oakbank crannog was accordingly selected for excavation with a degree of confidence in the prospect of uncovering more well-preserved

organic features and deposits within the mound, underlying the cover of boulders.

Practical considerations also played a role in the choice of Oakbank Crannog. The site is adjacent to easy access from the A827, the main road which runs along the north shore of the loch. Permission to set up a field office and equipment base in a field beside the shore was given by the proprietors. Accommodation, post-office, general store and hotel were within a few yards of the site.

The loch bed silt is of a suitable consistency for driving in control point stakes but wooden ones should be avoided because their buoyancy tends to draw them out over a period of eighteen months or slightly longer. To facilitate planning and the location of finds it was decided to lay a metal frame over the areas to be examined. Two adjacent areas have to date been delineated (fig. 24) and the system is very useful for the limited visibility of work underwater. The method is used in shipwreck excavations and is well demonstrated in Bass's Underwater Archaeology (Bass 1966).

The actual work of excavation was not difficult. Between 5 and 8 hours per day were normally spent underwater with longer periods when important tasks, requiring continuity, were carried out. The water is clean but light penetration is affected by the peat-colouring and visibility is diminished even close to the surface (pls 16 and 17). While working on upper layers the water

Plate 16

Plate 17

is very shallow (1-1.5 m) in summer (pl 21) but in late September, with the Autumn rains, the loch becomes 1.5-2 m deeper within 2-3 days. This is not only inconvenient but dangerous since personnel have got used to being able to stand up to reach the surface. Extra precautions are taken at this time (see Ch. 7).

Some problems are encountered when the organic matrix has been excavated to a depth of 40 cms or more as it becomes difficult to work among the upstanding piles (pl 17). Ultimately it is necessary to cut the piles flush with the surface of the excavated organic deposit. The cut sections are preserved and joined up with parts excavated later where a timber appears to be of importance. Often it is just the cut points which are preserved (pls 18-20).

10.2 Stratification.

A brief precis of the site stratification as observed in the excavated area will be followed by a more detailed description of each layer. There are indications from the work carried out so far that the stratified deposits about to be described are not necessarily similar across the whole site and, therefore, should not be directly extrapolated.

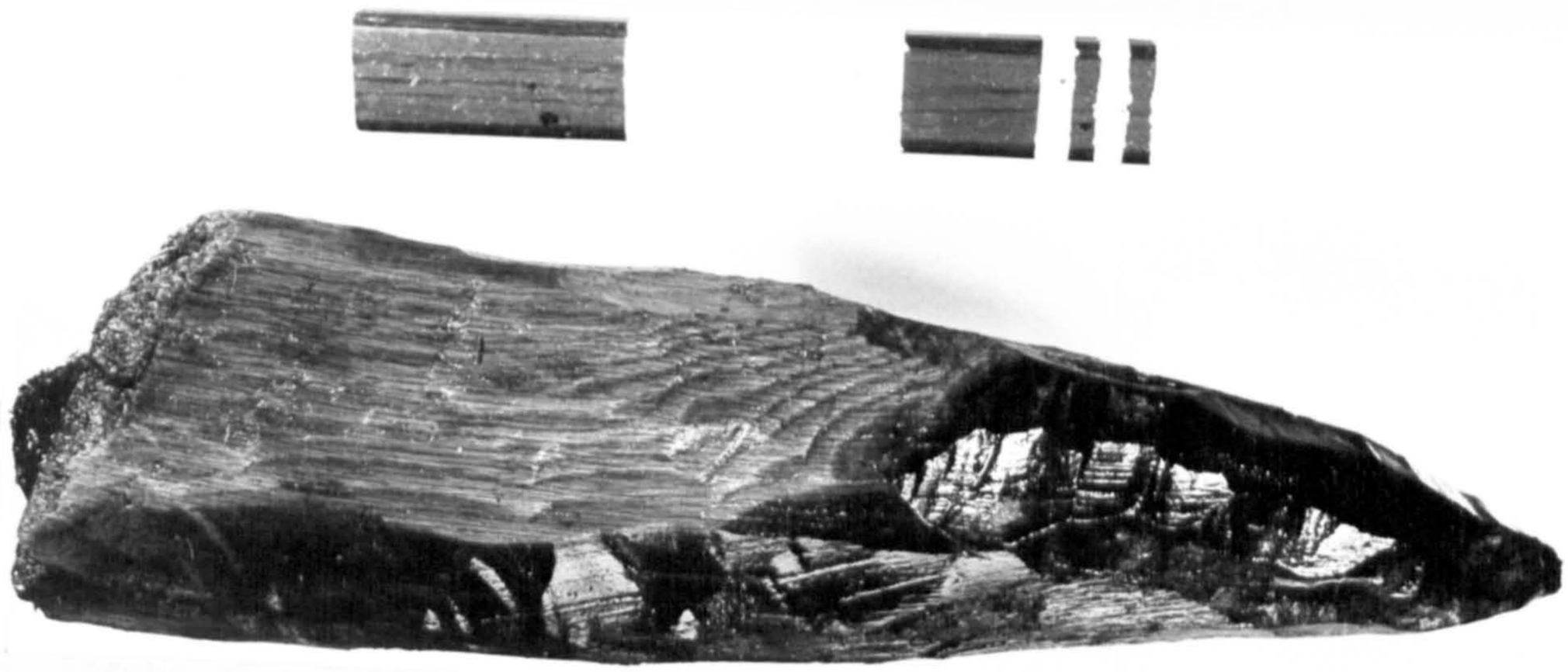


Plate 18

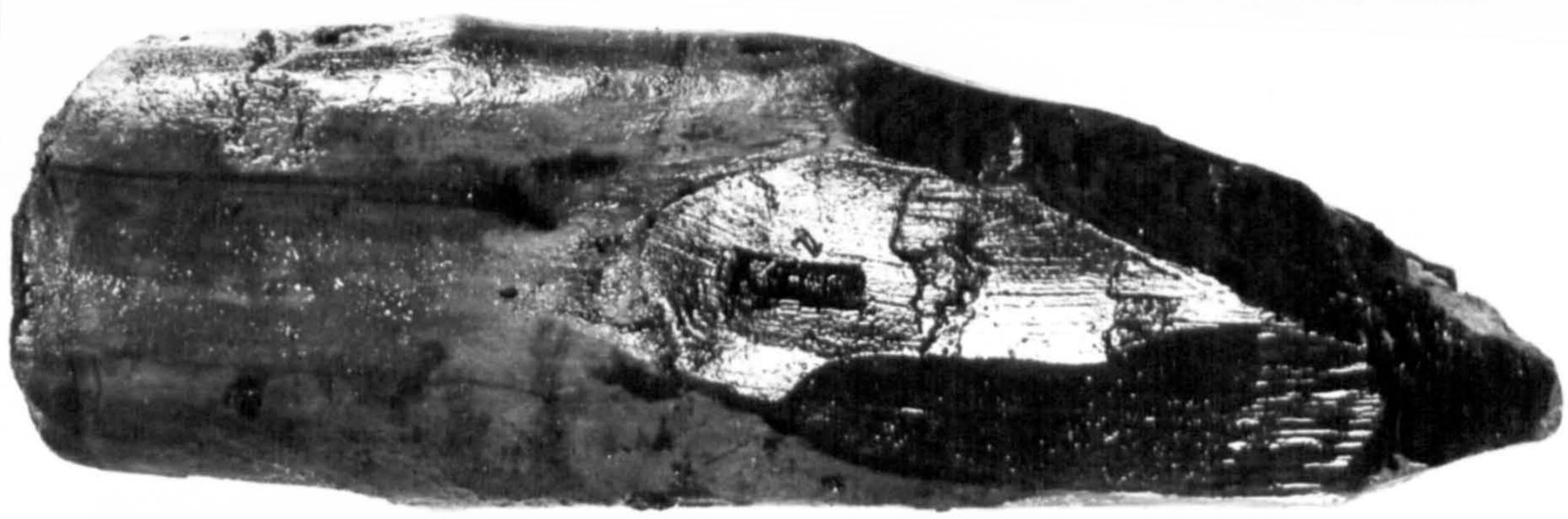
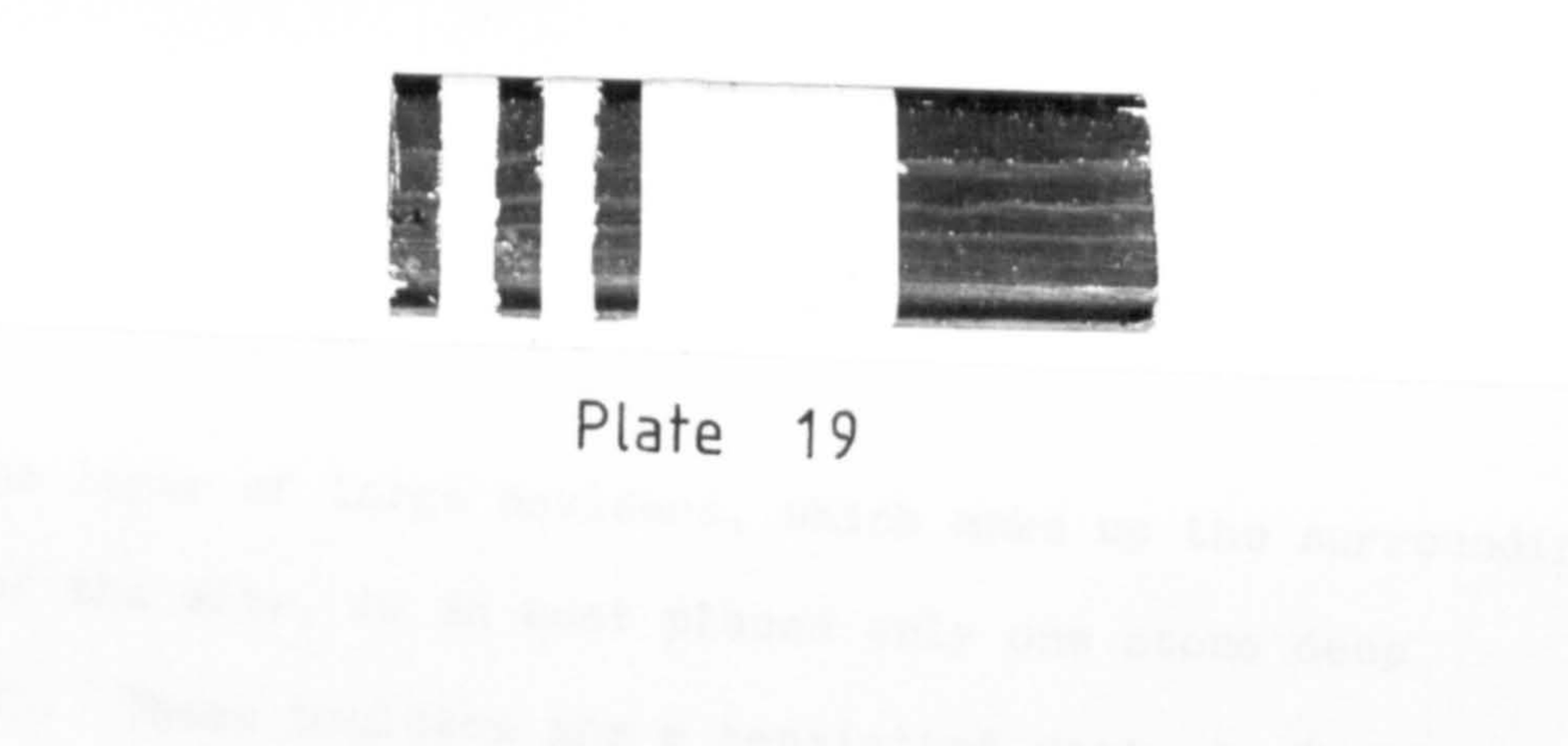


Plate 19

Plate 20



A layer of large boulders covers and surrounds the site (pl 14). It overlies on the top of the mound, firstly, a layer of smaller stones and then a thin layer of grit and silt. These layers lie directly upon a thick deposit of organic material in which are embedded upright and longitudinal timbers. This deposit can be seen in places to be made up of many thinner layers of vegetable debris but these are not always obvious. The organic layer lies directly upon the silts of the loch bed, into which some of the uprights have been driven. Other uprights are seen to have been driven into the organic deposit and do not penetrate through to the loch bed. There is a quite distinct delineation between the overlying boulders and stony layers and the underlying organic mass.

10.3 Removal of the Large Boulders.

The layer of large boulders, which make up the surrounding layer of the site, is in most places only one stone deep (pl. 22). These boulders are a consistent feature of all the crannogs in Loch Tay and Loch Awe and their presence is difficult to explain without further examination. At Oakbank they may best be considered in two groups. A band about 3.00m wide forms the periphery of the site and a layer, sometimes only one stone deep, overlies the top of the site.

Plate 21

Plate 22

The peripheral band may seem initially to be readily explained as supplying protection from water movement and erosion, preserving uprights supporting the upper structures. Large boulders piled around and against the vertical timbers would prevent the whole structure from swaying which would eventually loosen the grip of the piles in the loch bed and stretch structural joints. Such joints would also retard erosion of the piles by breaking the force of underwater currents and waves on the surface.

However, this apparently plausible explanation though it may apply to later phases of building on the site, cannot be substantiated by reference to the earlier phases at Oakbank. Excavations carried out in Area E (fig. 24) demonstrated clearly that the peripheral band of boulders in this area overlay a substantial sloping organic deposit. This is the extension of the main organic layers underlying the main mound where those layers thin out towards the edge of the crannog area. Embedded in this sloping organic deposit are the preserved bases of the uprights but no boulders. If the boulders had been laid down originally at the level of the loch bed for the purpose of protecting the piles they would still be in direct contact with the piles, embedded in the organic deposit, lying ultimately on the surface of the loch bed silts. They are not. In fact, the exposed part of the uprights appear to have eroded away leaving the embedded stumps preserved in the organic deposit before the boulders were laid down. No cavities were observed among the

boulders consistent with uprights having projected up through them, though these were sought for specifically.

From this evidence it may be reasonably argued that the first phases of construction of Oakbank Crannog involved a free-standing timber structure without boulders around the foundations. It would seem that that structure lay for a considerable period after abandonment, or at least after many of the original piles had been substantially destroyed by erosion. Then later phases of rebuilding included deposition of the circumferential boulder layer. Since the other seventeen sites in Loch Tay have the same boulder cover, demonstrably overlying organic deposits on a number of sites (see Chapter 8), and the same applies to those in Loch Awe, it would seem that the rebuilding of derelict crannogs utilising a substantial build-up of boulders may have been a technique developed at a later date than that applying to the original construction method. The difference in chronology of the two phases at Oakbank may be indicated by evidence presented below.

The single layer of boulders which overlies the area on top of the mound is also difficult to explain. If it had been laid before a structural timber phase, possibly to raise the overall level of the site, it would then be difficult to drive stakes into the underlying material. If it was laid after the insertion of upright stakes to help consolidate them, being only one layer deep, it would not be effective. Unless a simple platform with no associated roofed structure is postulated it is difficult to

reconcile this boulder layer with a timber framework. A simple stock pen could be envisaged if the boulders had been covered with a layer of earth or peat. There is no evidence of this being the case but the earth or peat could have been washed away after abandonment. Further excavation may supply a solution to the problem.

Underlying the layer of large boulders was a layer of smaller stones roughly fist-sized. These stones were only found in the area on top of the crannog. They were not observed beneath the boulders in the peripheral band. They have the appearance of having been deliberately laid down, possibly as a firm base for the upper stones to lie on. However, there is no evidence to prove contemporaniety of the two deposits. As in the case of the upper boulder layer the function of the smaller stones must remain a matter of speculation for the moment.

The third layer from the top of the crannog is a thin covering (1 - 3 cms) of grit and silt. It is probably the result of degradation of the upper layers and natural deposition of waterborne silt and requires no explanation in terms of human involvement.

10.4 Timbers and Organic Matrix.

Immediately underlying the three upper, stony layers was a deposit of organic material up to 1.5 m thick (pls. 22 and 23). This included: upright stakes and piles, some more or less vertical and others sloping steeply (pl 24); longitudinal branches and timbers, some in clearly associated groups and others of a single, random nature; and compacted vegetable debris consisting mainly of bracken and fern stems, twigs, straw, leaves and including insect remains, excreta and a wide range of seeds and nuts.

The range of timbers will be discussed first followed by the organic matrix.

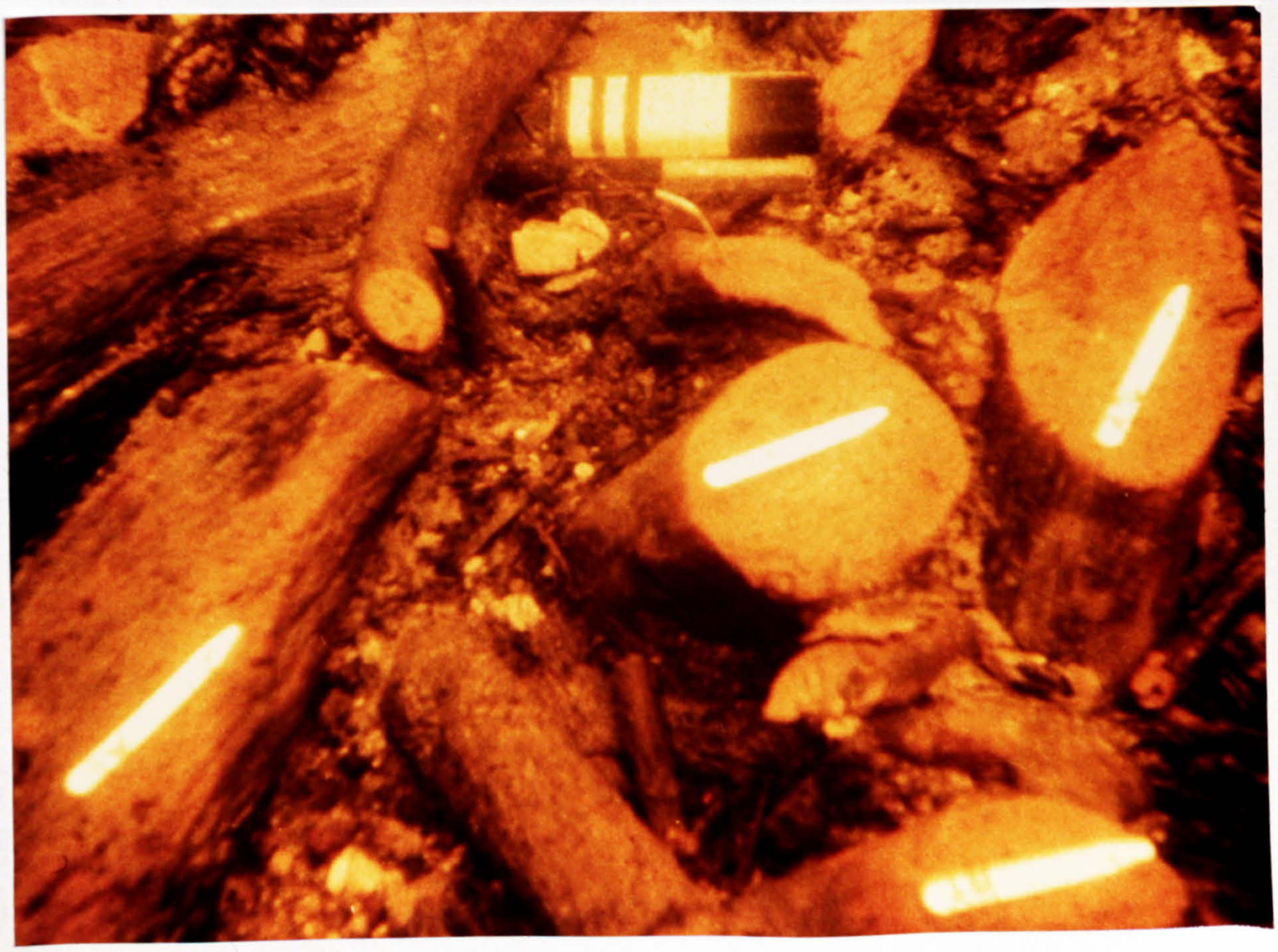
10.5 Timbers.

Uprights.

The stakes and piles range between 5 cms and 45 cms in diameter, with the majority around 10 - 15 cms. For the purposes of this work stakes are considered to be timbers set or driven into the organic matrix, and piles are considered to be timbers driven into the loch bed. Stakes are therefore secondary members while some piles at least are likely to have been part of the

Plate 24

Plate 23



original crannog structure. This is not however necessarily so with all of them.

It is not usually possible to tell whether an upright is a stake or a pile until it has been excavated. Most of the uprights belong to groups which were associated with more or less discrete features. The majority are part of two main groups embedded in the organic matrix of the main crannog mound. The outer group would appear to have supported a walkway, which was probably unroofed, around the periphery of the site and may also represent the remains of a stockade at the outside edge of the walkway. The inner group appear to be the outside wall uprights of a dwelling structure (fig. 25).

As noted above a distinct group of piles are in a linear arrangement between the crannog and the lochside and represent the remains of oak timbers which supported a gangway to the shore. Another distinct group, of alder piles, are set into the loch bed surrounding the small mound attached to the west edge of the site.

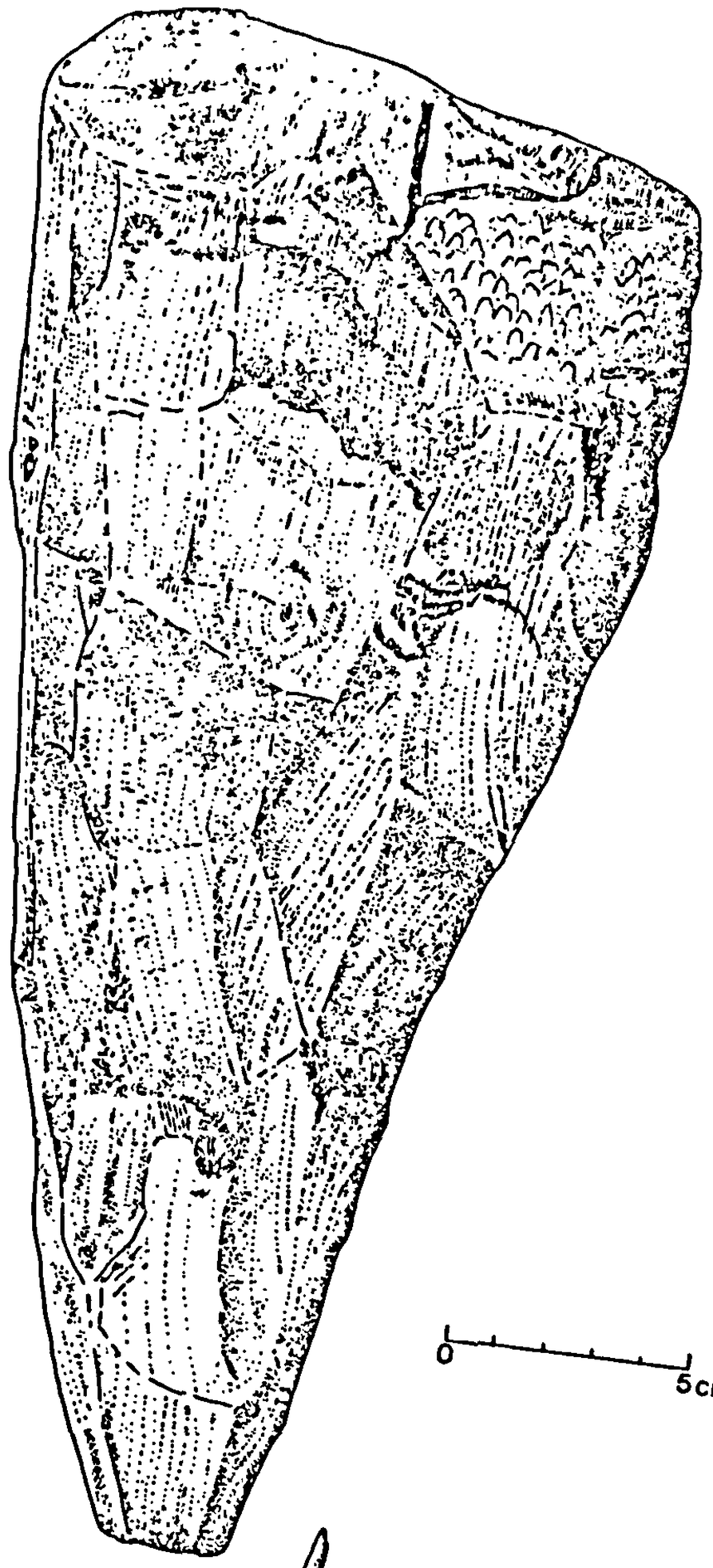
A row of stakes in the area of the longitudinal floor timbers on top of the mound were possibly the remains of a partition delimiting different areas inside the house or forming a wall between the inside and outside of the house. (see fig. 25 - upright nos. 431, 361, 399, 400, 401, 402, 392). The extremities of this row are not yet established. Some single uprights not associated with discernible groups are observed in

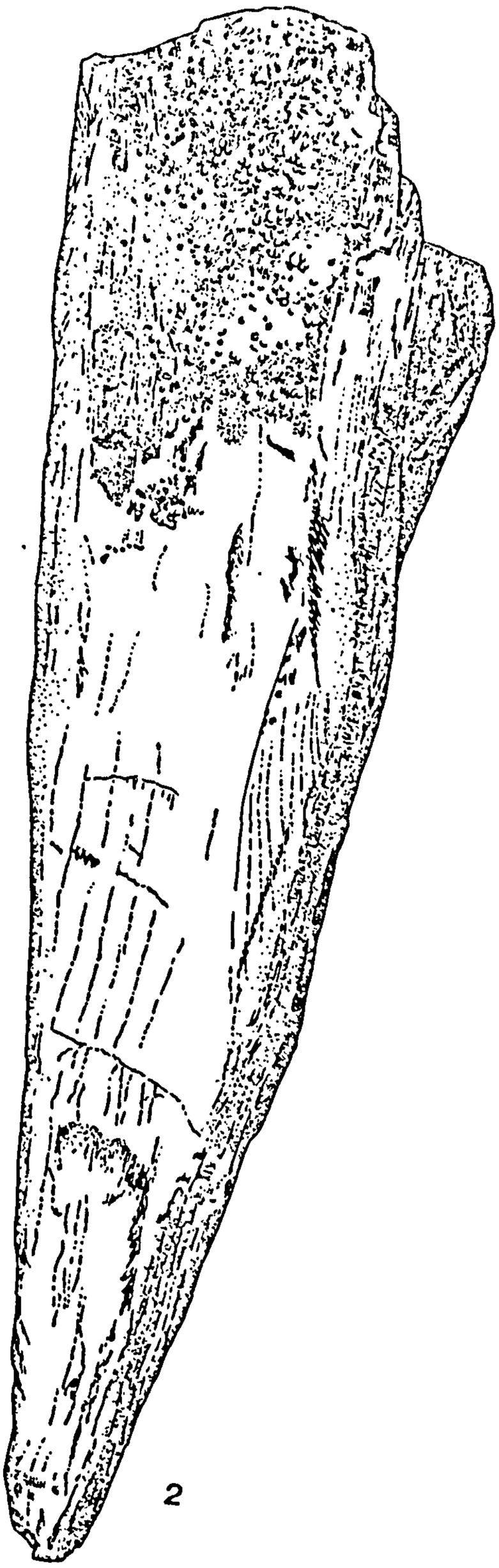
the loch bed silts in close association with the site.

A number of stakes and piles were excavated and all showed evidence of having been cut to a point at the lower end to facilitate driving them into the organic matrix or the loch bed silts (pls. 18-20. Figs. 28,29). In some cases cutting was discernible at the place where the stake projected from the organic material. These stakes were only set into the matrix to the level of the facets of the cut point and are clearly evidence of secondary construction on the site since the organic matrix must have been laid down prior to their insertion. Two of them (pls 58 and 59) were sent for radiocarbon assay and produced dates of 410+60 bc (GU-1463) and 455+60 bc (GU-1464). Many of the cut points are sufficiently well-preserved to show promise for examinations to establish whether it is possible to determine the type of tool used (pl 25). Notches or roughness on the cutting edge have left diagnostic grooves on the facets of some cut points.

Longitudinals.

Longitudinal timbers exposed in the excavated areas ranged from the remains of hurdles (fig. 24) of c. 2 cms. diameter to large structural pieces of up to 40 cms diameter. The most systematic groups are those which make up F17, the internal upper floor, and those of F24, the lower floor foundations. The close association and superficial appearance of the timbers in these two groups suggest that they were taken from the same stands of





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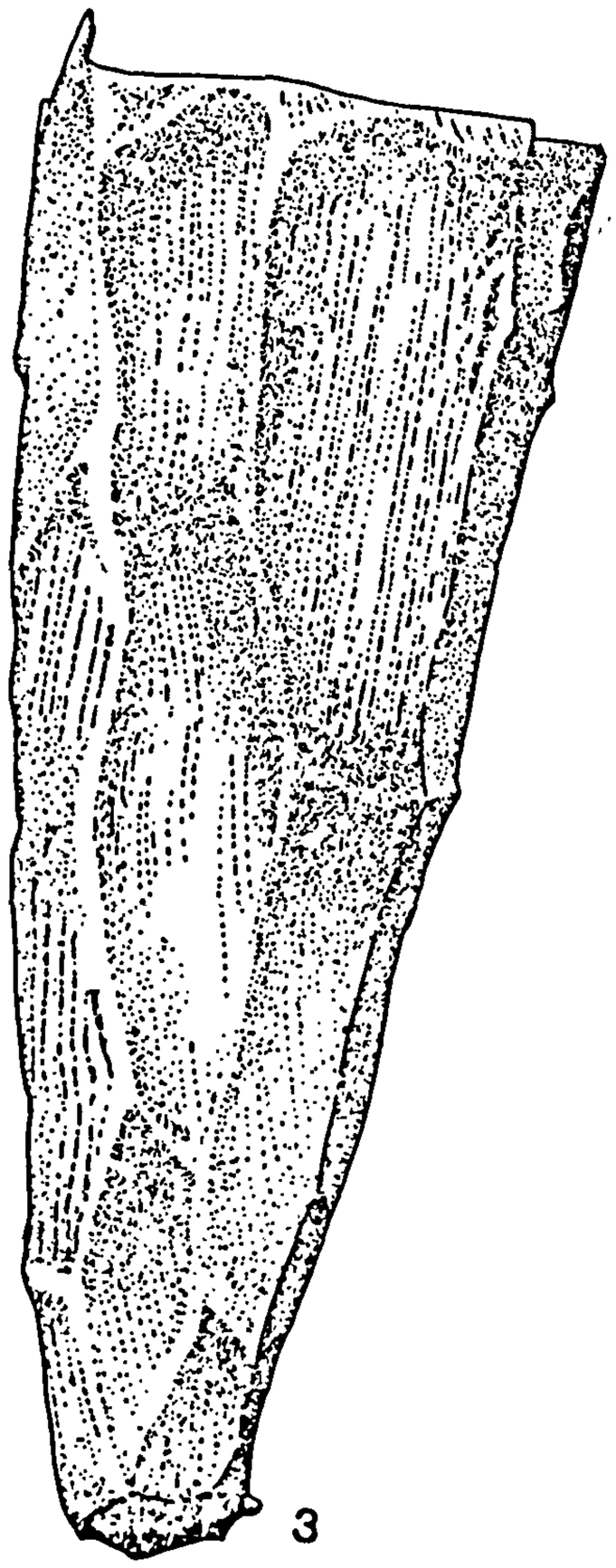

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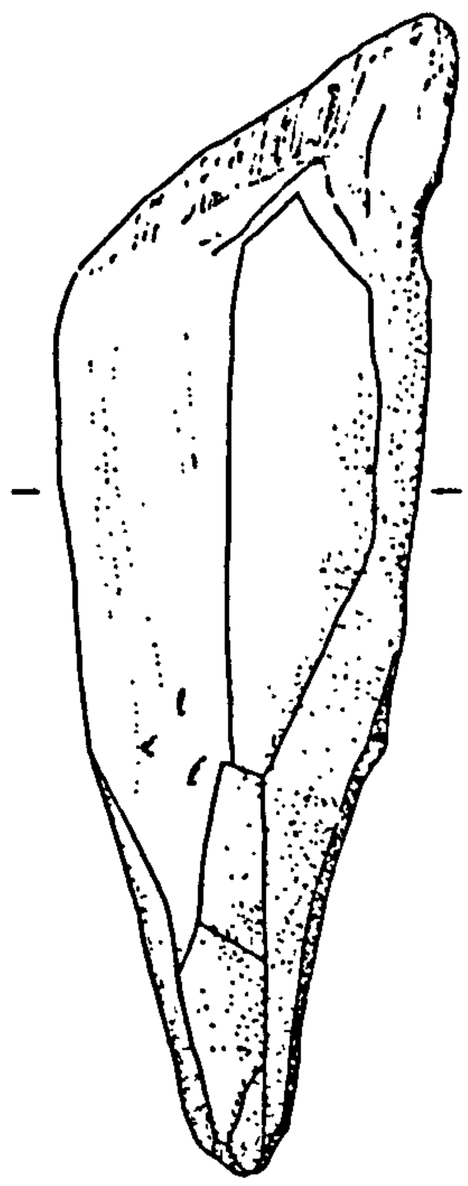
Fig. 28

4



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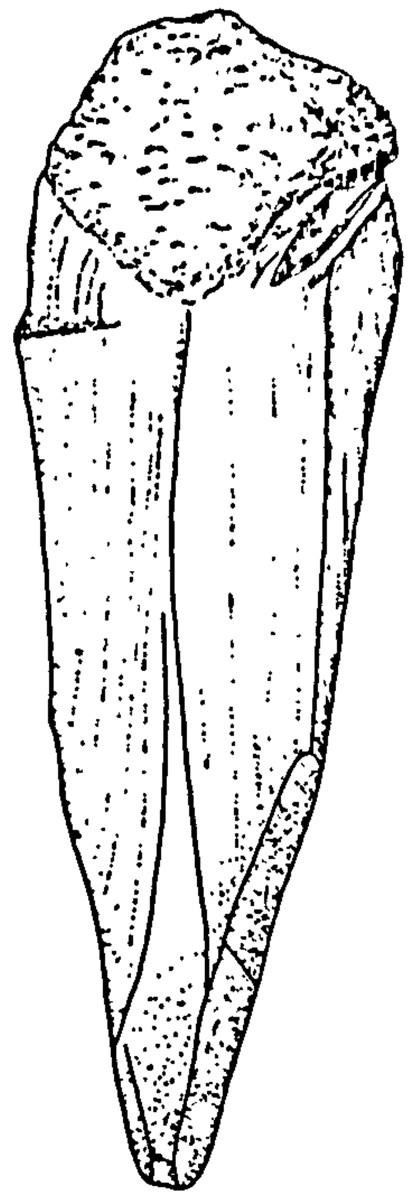


trees which may have been the results of coppicing. The upper timbers in particular were all of similar diameter and were straight stems up to 4 m long with little evidence of side branches. The lower layer was made up of smaller branches with less regularity than those overlying them, but with similar diameters within the group. A dendrochronological study presently in progress at the University of Sheffield may clarify the form of woodland management practised, if any.

Although a number of the upper floor timbers have been flattened on the upper surface (pl. 26), this appears not to be the work of man but of natural erosion. There were three layers of timbers making up F17 and the lower ones were roundwood with no upper flattening (pl 27). The eroded surfaces were covered by the upper layers of silt and stone and seem to have been degraded prior to deposition of the boulders.

Other structural timbers.

A number of other timbers which probably fulfilled structural functions on the site were discovered. They formed three main groups. In one group, F16, substantial oak timbers were in close association on the south side of control point Y (fig. 25). They were embedded in but projected from the top of the organic matrix. None of them was articulated though two (6 and 16) may have eroded tenons at one end and another (141) divided into two branches forming a crutch possibly for supporting another timber. Another substantial timber (473) in

Plate 25

Plate 26

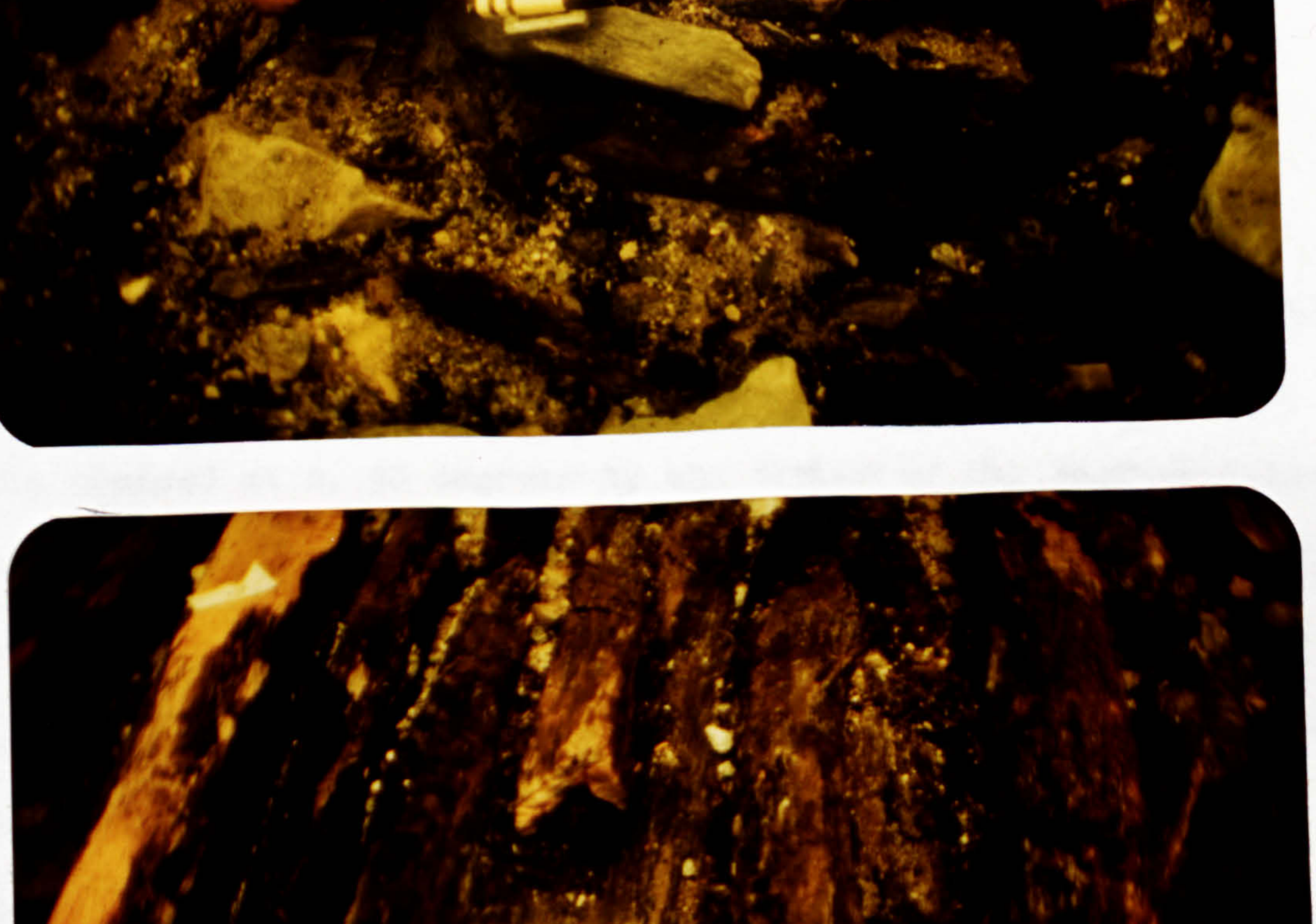


Plate 27

area E to the northwest of control point Y may also be a member of this group which has been displaced. It shows evidence of what may have been a stopped mortice at one end and divides into three branches at the other forming two crutches. The ends of the branches had been smoothed or cut flat in antiquity.

The position of the group may point to their utilisation as structural members of a door- or gateway. Since the gangway from the shore joined the crannog near or not far north of this area it is reasonable to postulate the existence of a strong entranceway here, requiring substantial upright and longitudinal timbers. The main part of the junction is in the unexcavated quadrant in the northeast of the site. Further work there may aid interpretation of the employment of this group of timbers.

Another group of structural timbers (F22) lie at a lower level than those just discussed and although they are not articulated where they are so far exposed they are distinctly associated in a recognisable pattern (see fig. 26). Six radially aligned beams, 7 - 8 cms in diameter and roughly 50 cms apart, are crossed at c. 90 degrees by one timber of the same diameter and a number of smaller sticks and at their inner ends overlie a number of other transverse timbers. The radial timbers are closely associated with and are possibly supports of a platform outside the dwelling entrance and probably also supported the peripheral walkway in this area.

OAKBANK CRANNOG

Plan Area D and part of B

Lower floor layer F24 F25 F22 F15

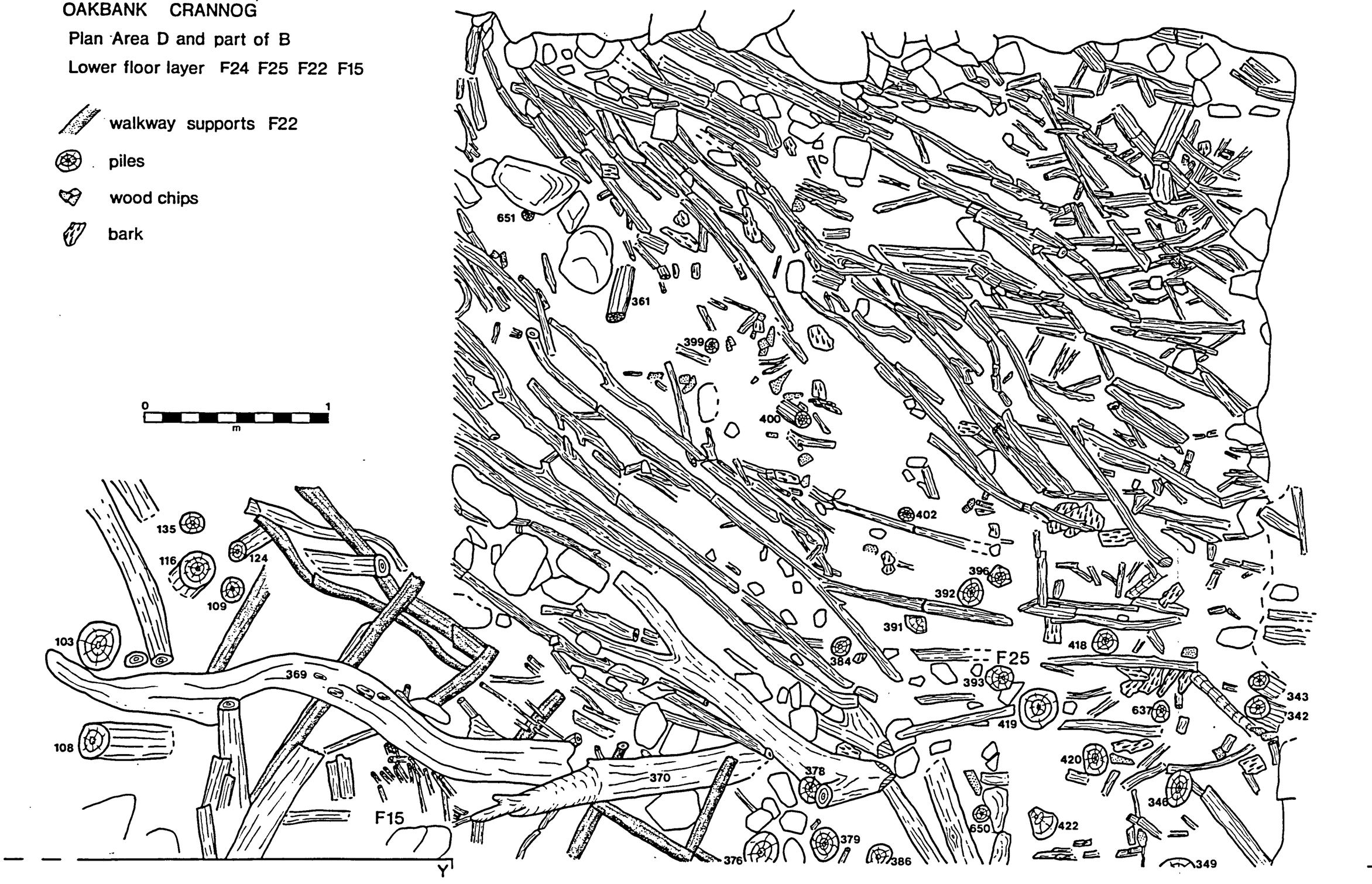
walkway supports F22

piles

wood chips

bark

unexcavated upper boulders



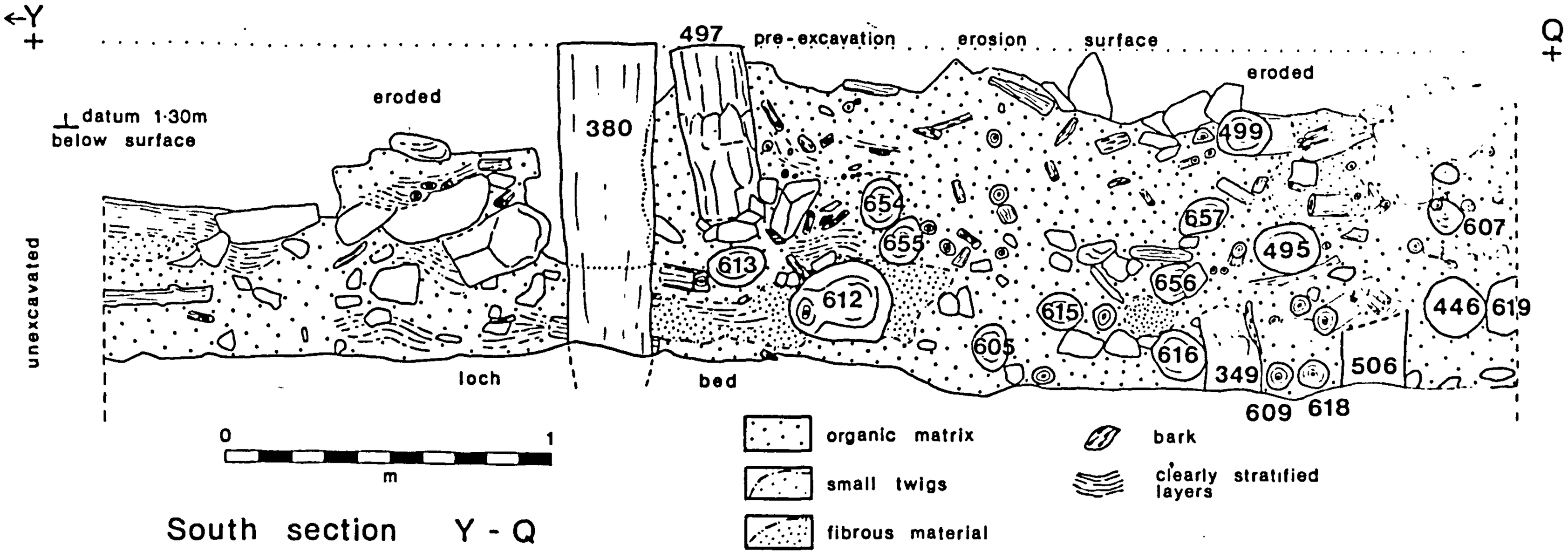
Similar arrangements were observed during the excavations of Buston and Lochlee crannogs by Munro in the nineteenth century. (Figs. 6 and 7). In these cases however the timbers had been dressed and the remains of mortice joints for fixing the structures were well preserved. The radial timbers and crosspieces were undressed at Oakbank.

A number of other longitudinal, structural timbers were observed in area E. Most were radially aligned and, though none was articulated at the exposed ends, two had remains of stopped mortices at one end while one of these was in close association with a disjointed tenon (fig. 24. Pl. 28). Most of these timbers were sufficiently substantial to have supported longitudinal transverse timbers carrying the postulated surrounding walkway.

The complexity of the array of timbers in this area is partly a result of the junction of the gangway with the main crannog framework here. Some of the longitudinal timbers are seen to lie partly within the circumference of the crannog mound and partly along the ridge of the gangway. Other timbers lead into the section YQ towards the centre of the site (fig. 27). The section shows that substantial radial timbers are found at most levels of the structure from the loch bed almost to the top of the organic matrix though none were exposed at the top in the examined area prior to excavation.

OAKBANK CRANNOG

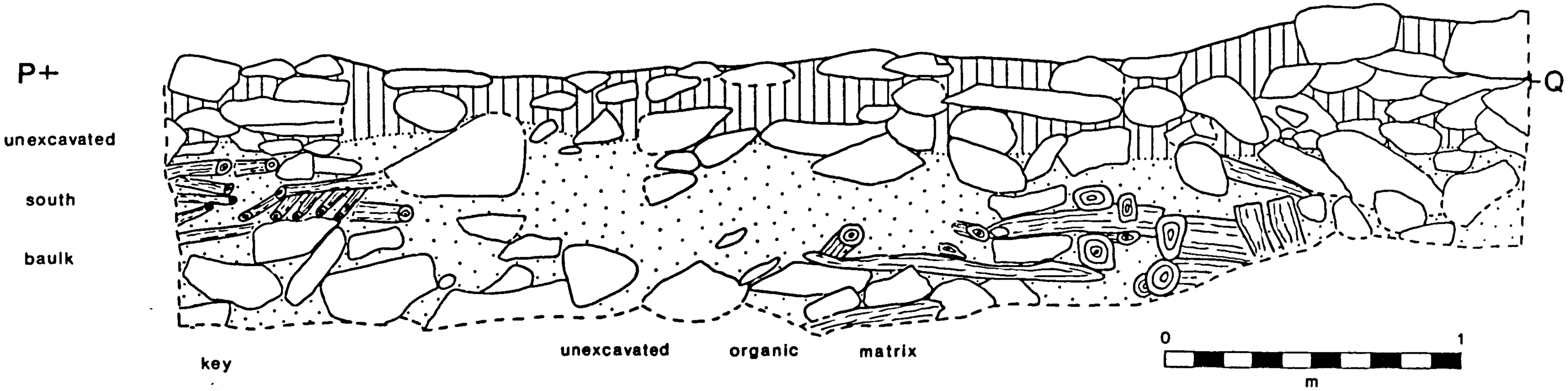
Trench E



South section Y - Q

Fig. 27

OAKBANK CRANNOG



West baulk - Trench D section P - Q

Fig. 35

10.6 Organic Matrix.

The wooden elements of the site are mostly embedded in a deep layer (ie more than 1 m thick) of organic debris and owe their excellent state of preservation to that layer. Where timbers project from the organic matrix they are eroded back to the surface of the matrix (pls 29 and 24). Only oakwood survives in open water and even here the bark and sapwood are eroded away and only the heartwood survives (pl. 30). The heartwood becomes what is commonly termed `bog oak' and is harder than fresh new oak. Timbers and other organic remains are also well preserved in the silts of the loch bed but are also eroded to the level of the silt surface.

The full range of processes involved in the preservation of the organic materials on Oakbank Crannog have not been comprehensively investigated and it is probably too simplistic to accept that the mere fact of being submerged is the only cause for the lack of degradation, though it may be the major one. Clearly the bracken, ferns, seeds, etc. were laid down in dry, or relatively dry, conditions, although the living floor may have been at least damp for most of the year. Yet most of the material is so well preserved that it appears to have been removed from conditions suitable for bacterial breakdown in a relatively short period of time.

Plate 28

Plate 29

Plate 30

This could have been a result of frequent laying down of new material for bedding and flooring without sufficient time intervening for serious degradation to take place. Added to this would be the effect of the high levels of polyphenols, or tannins, observed on the site derived from the quantities of oak and bracken utilised. Polyphenols would inhibit bacterial decay until the floor was finally submerged and anaerobic conditions prevailed and would continue to act afterwards.

Certainly the standard of preservation of plant and insect material embedded in the organic matrix is very high. A vivid example was the discovery of a complete wild cherry. Cherry stones abound at all levels but the flesh of the fruit, either through being eaten or through degradation, does not normally survive. Unfortunately the slightest pressure on the fruit caused the flesh to disintegrate leaving only the stone.

The organic mass consisted of substantial proportions of bracken stems and fronds and other ferns, twigs and small branches with a wide variety and high concentrations of seeds, straw, excreta, insect parts and puparia in a general matrix of comminuted vegetable debris (see pl. 4).

This mass of organic debris initially gave the impression of being one heterogeneous layer but excavation proved this not to be the case. Layers of compacted material could be peeled from underlying layers occasionally with a seam of insect puparia,

seeds or animal droppings marking the boundary between the layers. In other cases the distinct strata were accentuated by different alignments of bedding material. One layer may have bracken stems projecting from a section with stems in the over- and underlying layers lying along the line of the section. In some cases these layers were compressed to less than 1 cm in thickness.

Sometimes less regularly laid deposits were encountered. High concentrations of wood chips were found in well-defined areas and elsewhere what appeared to be deposits of coarse sawdust were uncovered. Some deposits were mainly fibrous with bracken stems and straw (pl. 9); others were soft and creamy with few stems (pl. 10); yet others with little fibrous material were very hard-packed and required excavating tools to break them up.

The different layers and deposits, except for the clear vertical separation between some layers noted above, blended irregularly one into another. It was not possible in most cases to define a clear line of distinction. No single stratified deposit could be followed for a significant distance in any direction.

This discontinuity may not be typical of the whole site. The area excavated so far is on the periphery of the crannog near the junction of the gangway and the main walkway and in the region of what was probably the main entrance to the dwelling interior. The peripheral position would be a zone of spillage and

slippage. The structural position would mean a great deal of traffic on and off the island and in and out of the dwelling. The concentrations of animal excreta and the situation near the gangway end suggest that this area may have been used for housing stock with the resultant disturbance of the flooring. Elsewhere on the site where less traffic and disturbance were taking place the stratification may be more clear and continuous.

The results of pollen analysis from a 10 cms diameter core taken through the top of the organic deposit down into the loch bed may also give a clearer understanding of the different phases within the deposit. The core was taken from a position c. 25 cms northwest of control point Q (fig. 24. App. E).

10.7 Features.

Timber structures.

A full list of features and the timbers which support their conjecture is given in Appendix B .

Twenty-five features are postulated, within the excavated area of Oakbank Crannog. When considered together these may represent the remains of the dwelling entrance and associated elements (fig. 25. pl. 12). An entranceway is evident leading from a platform or walkway, in the northeast, into the interior

of a dwelling, to the southwest. The entrance is flanked by two sets of uprights, F3 and F4, the major elements of which are substantial piles possibly representing gate or door posts. Leading to the south from F3 is a slightly curved row of evenly-spaced piles which supported the inner edge of a walkway surrounding the house.

Three arrangements of uprights, F8 - 10, butting onto the line of F1 at their inner ends and leading out towards the edge of the site may have carried substantial transverse timbers which in turn supported walkway timbers round the circumference of the mound. The site to the north and east of these features has not been excavated and it remains to be seen whether more uprights exist nearer the edge of the mound and if so in what arrangement. Three piles have been discovered set into the loch bed roughly in line with those of F8 at the outer edge of the crannog mound. F1 would also then be the main supports for, and the line of, the outside wall of the house.

To the southwest of F1 is a double row of uprights, F5 (pl 24), which may represent supports for an internal partition wall or roof supports or both. The lines of F5 and F1 converge in the south side of area B.

The same basic arrangement of door/gatepost, outside wall, walkway supports and internal roof or partition supports is discernible to the northwest of the entrance, though less clearly than in the southeast. F4 is the closest equation in pile

pattern to F3 on the opposite side of the entrance but timber 380, by far the largest pile in the area, terminates the outside house wall F2. 380 is a primary timber penetrating the loch bed (fig. 27) and may have been an element in the doorpost structure, a major support of the outside wall and a significant component in the junction of the shore gangway and crannog peripheral walkway.

F2, the external wall supports of the dwelling, are less clearly aligned than their counterpart to the southeast of the entrance, F1. Nevertheless, the curved outline is evident. Whether the substantial timber, 504, should be assigned to F2 or F6 is not yet clear. F11 - 13 equate roughly with F8 - 10 as major upright supports for the encircling walkway but timbers 453 - 455 in F11 and 458 in F13, which are substantially larger than their counterparts on the opposite side of the entrance, may have played a dual role. The west edge of the shore approach is seen to join the main mound at this point and these uprights may represent a stronger element for increased support. However, it should be noted that the pile stumps of the gangway are oak and the above examples are of a softer wood, probably alder. It is possible that they are not even contemporary (see below).

F6 may represent supporting uprights for the roof or for internal partition walls with the same general function as F5 in the southeast. It is difficult to establish a clear pattern of uprights in F6, partly because F7 (see below) encroaches upon F6 in this area and a number of uprights fit readily into either

feature.

One of the clearest features, at least in part, is the remains of an internal partition, F7, in the form of the stumps of a number of stakes running from southeast to northwest and delimiting the northeast edge of the upper floor timbers, F17. To the northeast of F7 and lying between F5 and F6 at the same level as the inner floor, F17, was an area of substantial boulders. Since the lower parts of these were embedded in the organic matrix they are associated with this phase of habitation and not the overlying boulder cover. As with the upper stones the purpose of those adjacent to F7 is not clear for the same reasons.

The distinction between the floor forms on either side of the partition wall, at this level, is obvious with the boulders on one side and the timbers of F17 on the other pointing to different purposes in their construction. On excavation of both features it was discovered that a common floor (F24. Fig. 26) underlay them both. The branches forming this floor are thinner than those of the upper floor layers and although embedded in the general organic deposit no distinct layer of habitation material appeared to lie on the lower floor, suggesting that this may represent a foundation layer for the upper floors and not a living floor surface. The paucity of artifactual evidence at this level would support this hypothesis but there is evidence to suggest that the partition wall stakes were erected at this level. The points of the stakes are embedded in organic material

here but are loose and clearly do not penetrate far into it. In fact the facets produced during the process of cutting them to a point were, in some cases, visible and some stakes were removed during excavation.

Significant numbers of wood chips and loose bark around the partition stakes and along their line indicates that they were probably cut to a point here immediately prior to their erection. To either side of the line of uprights is an area clear of the branches of F24. The purpose of this clear lane is not evident. It would appear to operate in the same manner as a bedding trench does for a stone wall and may have been left clear when the lower floor was laid down. Since the foundation layer, F24, has not yet been excavated it is not possible to say whether an earlier partition wall existed on the same line as the existing stakes.

In the northwest corner of area D, at the same level as F24, are a number of horizontal branches (F25) with cut ends (fig. 25). They are aligned roughly east - west and since a number of uprights stand between them they may represent remains of fallen walling rather than a floor. Clarification of F25 may be possible when the area to the west is excavated.

Stone Features.

The later overlying boulder cover and the peripheral band of stones have been discussed above and as indicated represent a late phase or phases of habitation. Stone features in association with the main organic deposit and timber features are not yet clearly exposed in most cases. Those which are exposed, such as the boulder area to the northeast of the partition wall, do not enable clear interpretation (see above).

The putative hearth, F20 (fig. 25), is not yet sufficiently exposed to establish whether it is indeed a hearth though its position, charcoal and burnt stone in association with it make this a reasonable supposition. Heavily charred branches were also found nearby (pl. 31). Excavation of this area will clarify the situation. The same applies to F21.

10.8 Section Y-Q.

By the middle of the 1981 season of excavation it was apparent that a number of questions could best be answered by cutting a section through part of the site. Accordingly section Y-Q (fig. 27) was begun in that season and completed during the 1982 season.

The aim was to supply information regarding the foundation structures and the relationship between the peripheral boulders and the many uprights around the edge of the site. A thin spread of organic material had been observed projecting from beneath the outside stones of the main mound on the loch bed in the area where the causeway joined the crannog. The relationship between the boulders and this deposit required clarification.

Another reason for cutting the section was to see if it was possible to distinguish distinct stratification within the organic deposit. It was already established (see above) that there were differences in texture and that in places layers could be clearly peeled off exposing deposits, obviously in situ, of insect puparia, animal droppings or seeds. It was possible that more systematic strata might be observed in section.

It was also a matter of interest to observe by how much the loch bed silts had been compressed by the weight of the crannog material since this was conjectured as one of the reasons for the eventual submergence of this and other sites. In fact, it was considered to be probably the major process of submergence. Related to this question was the amount of silting that had taken place in the last two and a half millennia. A substantial build-up could mean the preservation within the silts of the remains of canoes, fish-traps and objects which had fallen from the crannog when it was inhabited, as well as early foundation elements not protected by being embedded in the organic matrix.

It was also important at this relatively early experimental stage of crannog excavation to establish whether a section could be successfully created and maintained in the organic matrix.

Results from Section Y-Q.

No major difficulty was encountered in creating the section. The deposits, including all types of wood except oak, could be cut with a sharp trowel or knife and care had to be exercised not to cut through wooden artifacts. The section maintained itself with little degradation of the face though the top edge was liable to erosion if not protected from wave action. Even after a year the section was still vertical and, probably as a result of oxidation (though the process has not yet been fully studied) a hard surface had formed to a depth of about 2 cms, protecting the unexposed deposits. This protective coating was only seen on deposits exposed by the excavators and not on original material which had been protected by stones or gravel.

Beneath the boulders the organic deposit was seen to have spilled out between the uprights of F6 and F2, forming a slope of about 45 degrees. This explained the thin organic deposit observed at the outside edge of the stones: it was the bottom edge of the organic slope. The boulders lay on the slope and were not embedded in it. Many of the uprights in this area appear to have collapsed outward toward the edge of the crannog (eg 492, 493, 494, 499, 495, 504 and 505. Fig. 25) possibly as a result of the weight of organic material bearing against them

from the middle of the site. Also possibly as a result of lateral pressure applied by roof beams.

In the section four large uprights were recorded (380, 497, 506 and the cut point of a substantial pile, possibly 349, at the base of the section about 50 cms east of 506. Fig. 27). Numbers 380 and 506 are primary piles since they are solidly driven into the loch bed silts far enough to completely cover the cut points. 380 stood just in front of the section and an attempt was made to draw it from the silt but this proved impossible without excavating the point. Both 380 and 506 were most probably erected prior to the build-up of organic material around them and should represent the earliest phase of construction on the site.

In contrast to these two piles timber 497 is clearly a secondary upright from a later phase of rebuilding. The cut point has been driven into the organic deposit after the deposit had been laid to a depth of at least 90 cms and possibly deeper (see pls. 32, 33). It does not penetrate through the organic deposit and into the loch bed. Its proximity to 380 suggests that its purpose may have been to strengthen or replace the earlier pile and that whatever function 380, and later 497, served it was one requiring very substantial support. It has already been suggested in the discussion of features that F2 terminated in 380 and that here, or in F4, was the main door/gate- post on the west side of the entrance. Either function would justify the use of such large uprights.

Plate 31

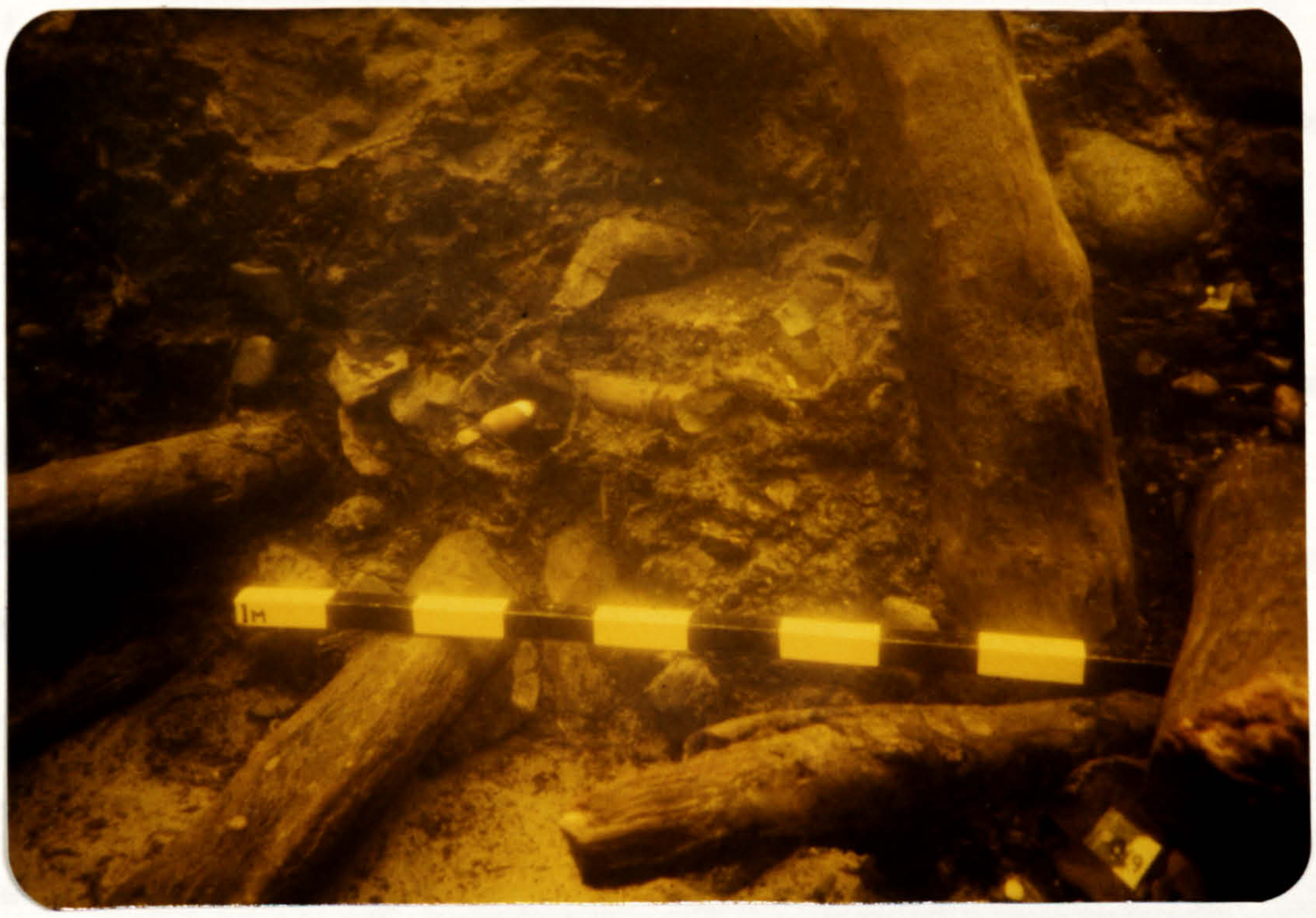


Plate 32

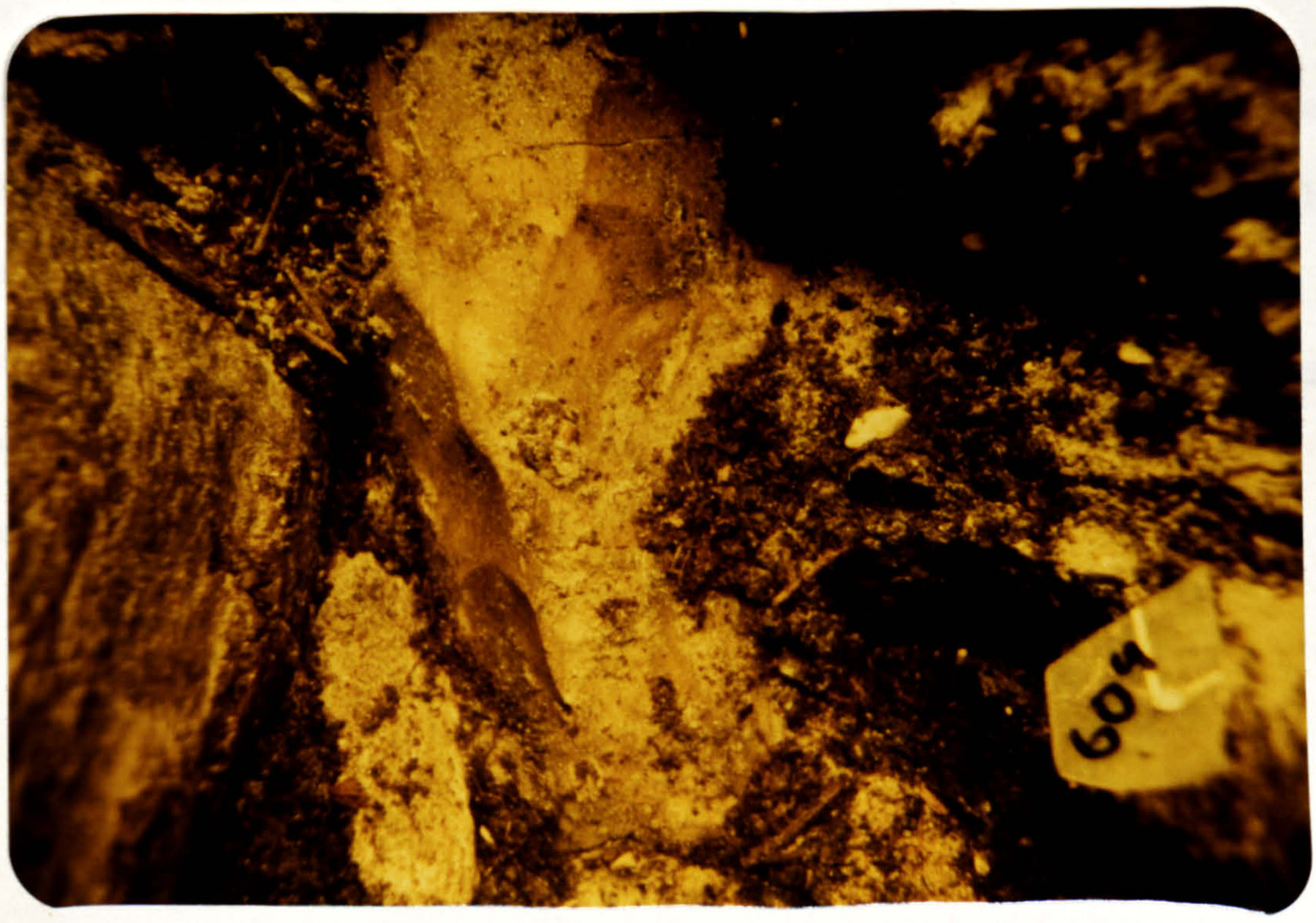


Plate 33

The cut point, possibly of timber 349, which is partially exposed at the base of the section (fig. 27) may also be a timber from a secondary phase and and if this is the case it may represent a phase of reconstruction or strengthening earlier than the phase represented by 497, since 349 penetrates substantially further into the organic matrix. It is doubtful whether even a pointed stake could be driven this far through the main deposit suggesting that there was less depth of material when it was set in. If 349 was a primary pile it would have served little purpose since it appears to penetrate the loch bed only minimally and would not have offered a firm support.

The ultimate purpose of any of these four uprights can only be a matter for speculation since their upper ends, which presumably once formed tenons or checks as part of a joint, have been eroded away in antiquity. This applies to all of the uprights excavated so far and it is possible that no articulated upper joints exist now on the site. An indication that articulated, or disarticulated joint elements, may yet be discovered is seen in a cut pointed end of a stake projecting from the side section east of the main section Y-Q just northwest of control point Y (see fig. 24. Pl. 34). The low level of this stake and the condition of the point, which is well preserved, suggest that it may have fallen over and been buried in antiquity and the upper end, still in the section, may also be well preserved.

Plate 34

Section Y-Q also exhibits the cross-sections of a substantial number of longitudinal trunks restricted to the west half of the section. It is notable that the great majority of these timbers lie more or less radially in relation to the crannog and are found mostly in the lower half of the section. It is assumed that most of these longitudinal timbers are not still in situ though they may not be far from their original position and alignment. This assumption is made on the basis that most of the timbers were transverse supports jointed to the numerous uprights nearby to carry the circumferential branches forming the walkway. Presuming that the walkway was above water then the radial supports must also have been either above water or close to the surface. Therefore, when the connecting joints degraded the transverse timbers dropped and came to rest on the organic deposit building up on the loch bed.

If this is the case the higher timbers may represent periods of structural repair and the replacement of rotted supports. Credence is lent to this assumption by the remains of a stopped mortice at the outer end of timber 612 (fig. 25). Presumably the joint was not made at loch bed level where this timber was lying prior to excavation. The same argument applies to the other radial trunks particularly 605, 616, 618 and 619 which are at a very low level and would serve no purpose there unless the water level in the loch was extremely low.

The section also shows a significant lack of large stones within the organic matrix (pl. 32) and particularly in association with the lower parts of uprights where they penetrate either the loch bed or the organic matrix. It is evident that boulders were not a significant element in the construction techniques of this site prior to the deposition of the peripheral band of stones and the overall covering of the mound.

From the above evidence it may be deduced that the first structure on the site was a free-standing pile structure with substantial uprights represented in the section by timbers 380 and 506. Uprights such as these represent the outside of the house and the inside edge of a surrounding walkway. The outside edge of the walkway in this area would be supported by an outer ring of substantial piles such as 453 - 455, 444 and 445 (fig. 25). Further discussion of the structural development of the site is included in Chapter 12.

Above the surface the space between structural uprights would have been filled with hurdles, horizontal uncut saplings or planks. It is notable that remains of a hurdle, F15, lie among the fallen structural timbers of F16, 50 cms southeast of control point Y. Fragments of burnt daub were discovered elsewhere on the site.

Stratification of Section Y-Q

Clearly stratified deposits are observed in the section but only in localised patches (see fig. 27) and nowhere could extensive, distinct horizons be discerned within the overall mass of the organic matrix. The most obvious layering was seen to be in the east half of the section separate from the area of horizontal radial timbers. This may have been as a result of differential disturbance. The material in the area where most construction and reconstruction took place would be periodically disturbed and mixed while the area with few timbers, and therefore with no building or rebuilding, would be relatively undisturbed. Since this area of the site is established as an area of disturbance during habitation by virtue of its proximity to the entrance the prospect of more distinctly stratified material in less disturbed areas of the site is promising.

Patches of material of different textures were discernible in the section as they were elsewhere in the excavation. These textural differences have not yet been fully examined but initial observations have shown that within the common organic matrix of comminuted vegetation, other materials which have not broken down are embedded. Bracken and ferns produce a tough fibrous mat with the clearly recognisable stems projecting. A soft creamy material suggests a situation where possibly wet excrement has been collecting. A crumbly deposit has been observed to contain quantities of apparently sawdust though similar material is produced by nest building insects or even mice. A close examination of these deposits may offer important data regarding

the function of small localised areas of the site since they are ultimately the residue of the activities of the sites inhabitants, both people and animals.

Silting and Loch Bed Subsidence.

The section demonstrated unequivocally that in this part of the site there has been effectively no build-up of silt since construction of the crannog. The boulders and organic deposit lie on the original loch bed silts and show no evidence of having been covered around the edges by later material.

The supposition that crannogs are submerged partly as a result of subsidence of the loch bed due to the weight of overlying materials has been proved false in the case of Oakbank. It probably does not hold for the other Loch Tay sites either. The base of the section lies flat on the loch bed with no evidence of a depressing effect (pls. 32 and 34). The cause of submergence of Oakbank Crannog, and possibly of many other submerged crannogs in Loch Tay and elsewhere, may be considered in terms of internal collapse and compaction as a result of biological and mechanical degradation.

The excavation of Section Y-Q was proved justifiable by the information it supplied regarding the structure of the site and the formation of the remains in this area. It showed that sections could be created and that their maintenance offered no significant problems. The observations with respect to silting

are of interest to this site and the discovery that no loch bed subsidence has taken place is important for the contribution it makes to the general discussion of crannog submergence.

Chapter 11.

Oakbank Crannog, Loch Tay: Excavation.

Part 2: Artifacts and Environmental Material.

11.1 General Description.

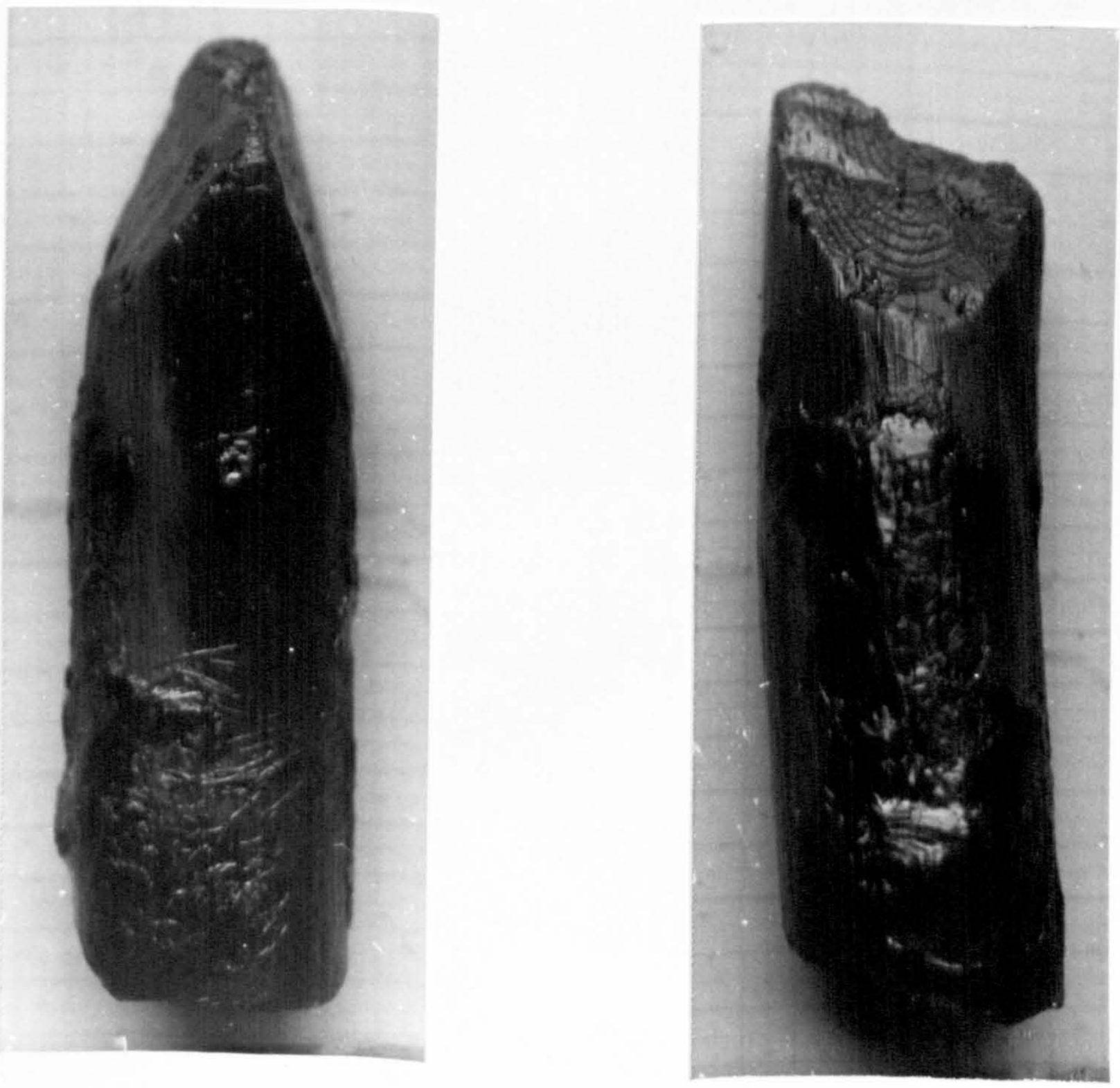
The finds from Oakbank Crannog may be divided into three broad groups for ease of discussion. The first group is artifactual material which covers everyday domestic and industrial paraphernalia used by the crannog dwellers including wooden and stone objects, pottery and flint. The second group is residual material which covers wood chips and the waste from carpentry, slag from metalworking, and daub. The third and largest group is environmental material such as macro-plant remains, excreta and insects.

Unlike the great majority of dry land sites where finds are objects usually liberated from a naturally formed or deposited matrix of soil and/or subsoil which is mostly regarded as spoil to be discarded, the crannog at Oakbank is an almost wholly anthropogenic feature with minimal quantities of naturally deposited material. It can be seen as a single highly complex

artifact. There is no archaeologically sterile spoil to speak of equivalent to that on a land site and almost everything within, and including, the structure of the crannog is there by virtue of man's direct activities. This point is made to emphasise that even a featureless stone on the site is there as a result of a purposeful act. The purpose may never be known, but its existence should be considered.

On a dry land site it is often a relatively simple task to decide what is and what is not a find. Therefore, the decision of what to keep and what to discard is usually, though by no means always, clear-cut. On a site like Oakbank the great majority of the material would be classed as finds in terms of dry land excavation and the decision of what to keep and what to reject is by no means always obvious. For instance, there are probably millions of splinters or fragments of wood throughout the site. To discard all pieces which have no sign of working may be to discard a great deal of evidence for the construction of hurdles or the practice of coppicing. Many pieces are simply sharpened at the end but examination of them may explain the techniques used and their development (pl 35). To keep every piece with a cut end, however, may result in a massive collection of meaningless fragments of wood. Total quantitative analysis of such fragments would mean preserving the material from the whole crannog mound: an organic deposit of about 1,000 cubic metres.

Plate 35



In practise the excavation of a site such as this must be seen to a great extent as a sampling exercise. All timbers over c. 2 cms in diameter have a slice removed for dendrochronological analysis but unless there is evidence of working the rest of the timber is discarded. Although a representative collection of unworked pieces may be useful ultimately there are no facilities available for conservation of such material.

The situation is the same with stones. Unless a stone shows positive evidence of having been used as a hammer, rubber or other tool, even though it comes from the habitation layer it is not recovered. However, the stone dumps on the loch bed are not likely to be disturbed and would be available for analysis later if required.

11.1.1 Artifacts.

11.1.1.1 Wood

The majority of artifacts from the excavation so far are made of wood and they indicate a range of articles many of which must have been commonplace on contemporary dry-land sites also. They would have been as appropriate to the inhabitants of any type of site and are important for the insight they give into the range of domestic, craft and industrial equipment used in prehistoric households.

Objects of a domestic nature include a round plate, a coarse dish and a small bucket stave. The plate (pl 8) is finely made and shows a high level of woodworking skill. It is 18 cms in diameter and the rim is 3 cms high. The base is less than 5 mm thick and is of an even thickness all over which shows a great deal of care in manufacture since it is not turned on a lathe (fig 32.21). The rim is of a sloping triangular section with a strong but aesthetically pleasing appearance. Tool marks round the outside edge are vertical and suggest the use of a gouge for final shaping. It was found in four main pieces and two-thirds complete, embedded in the organic matrix beside a pile at a relatively low level in area E. The missing part was not found and the plate must have been damaged in antiquity and may have been discarded for this reason. It was made of alder.

In contrast to this finely cut plate was a coarse dish also made of alder (fig 32.22). It is very thick-sided and was hollowed out with little apparent effort made to smooth the surface of the wood. It appears to have been cut from a block of wood some 35 cms long, and 10 cms wide and 10 cms high. The upper edge is 2 cms thick and the sides slope down into the interior so that they are progressively thicker towards the base. One long side and part of the base are missing and seem to have been eroded away after the rest of the dish became embedded in the organic matrix. While the round plate is best suited for humans to eat from, the coarse dish could have served a variety of purposes. It may have been a serving dish or a container for food, a small trough for animals or even a bailer for a canoe.

A stave for a small container is probably made of apple or pear wood (pl 36. fig 32.20). It is c. 6 cms wide at the base and c. 12 cms high. The bottom of the side wall is 1 cms thick and it tapers to the rim. The bottom is rebated and six staves together with a circular base fitting into the rebates would form a wooden vessel. The pieces could have been held together by thongs around the outside and resin might have been used to seal the joints. Faint impressions on the outside may be evidence of binding. Its capacity is about 3/4 of a litre (1 1/2 pints) if it was a container for liquid, but it could also have been a measure possibly for grain or flour. Like the plate this object suggests substantial woodworking skill. The rebate is neatly cut and the taper from base to rim again points to an aesthetic

Plate 36

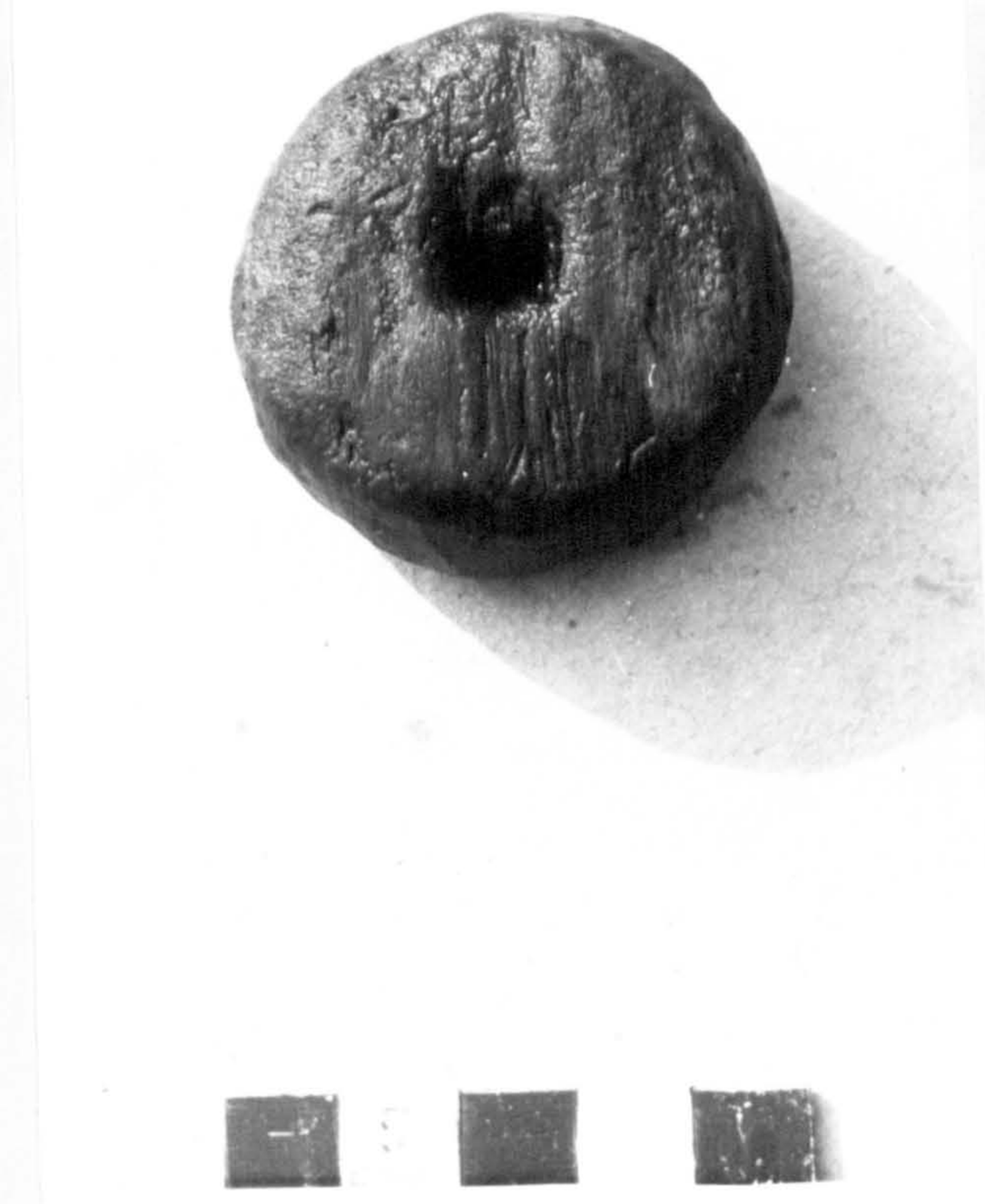


Plate 37

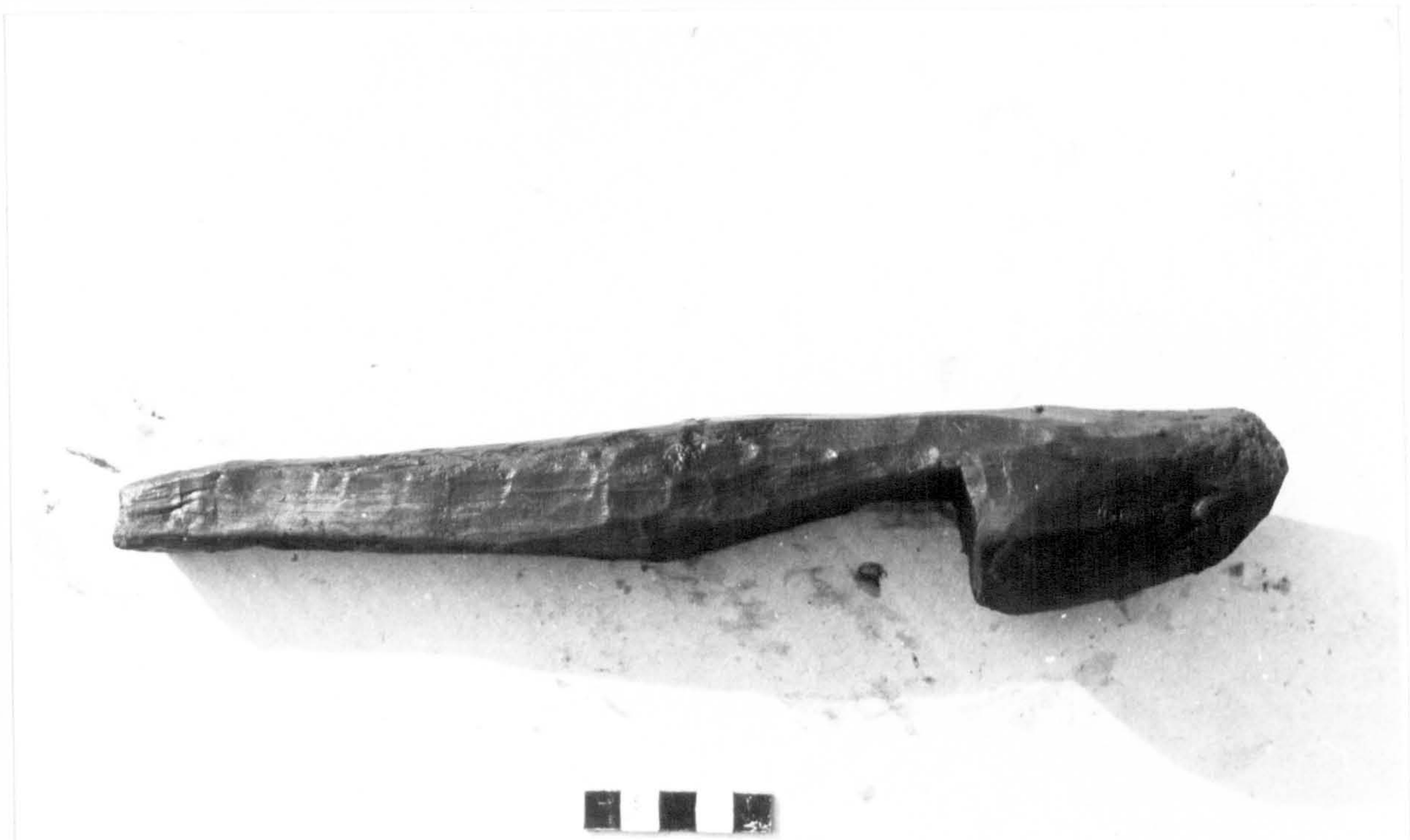


Plate 38

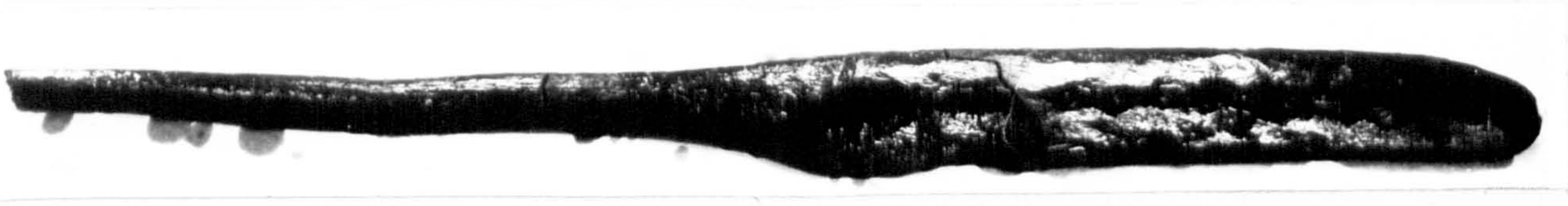


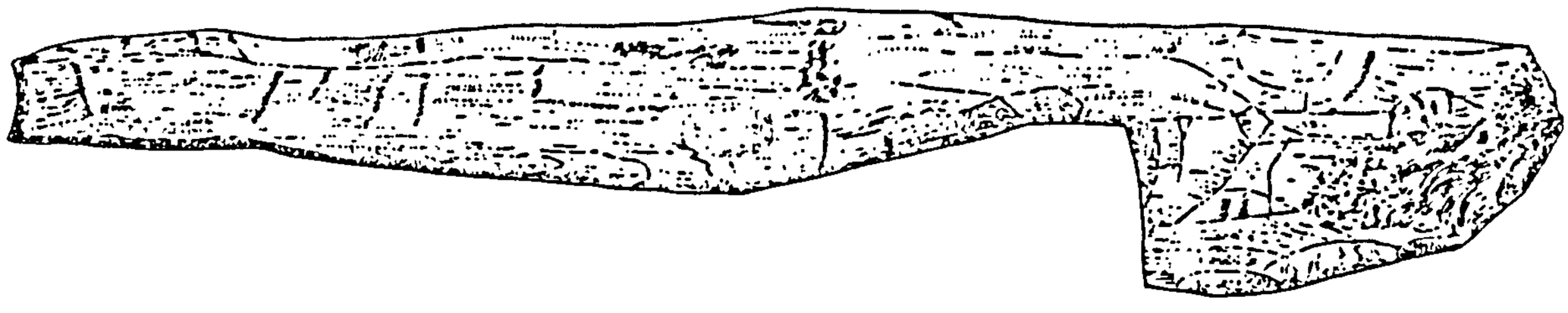
Plate 39

consideration as opposed to the purely functional. The accuracy of constructing six pieces which fitted closely enough together to make the body of the vessel reasonably tight suggests either considerable artistry or the use of a pattern.

Spinning is indicated on the site by the discovery of a wooden spindle-whorl c. 5 cms in diameter (pl 37. fig 31.19). It was cut to shape, not turned on a lathe, and as with the other wooden artifacts the toolmarks are still fresh. The perforation was squared at one end and presumably the spindle was so shaped that it neither turned in the hole or fell out in use.

The use of a sharp knife, about the size of a modern pen knife, is indicated by the tool marks on most of the smaller wooden finds and is admirably demonstrated on the surface of a wooden peg c. 25 cms long (pl 38. fig 30.7). The original function of the peg is not known but the pronounced notch on one side points to a situation where pressure is being taken in one direction. It would not, for instance, be used to tether an animal which could pull in all directions, but could take the strain on a rope used for holding down a haystack or a roof covering. It should be added that there is no sign of a rope indentation in the wood.

A wooden paddle made of alder was found complete but broken in two places (pl 39. fig 33.23). It is 1.35 cms long and similar in form to modern canoe paddles with a convex back to the blade and a relatively flat face. A notch in the edge of the



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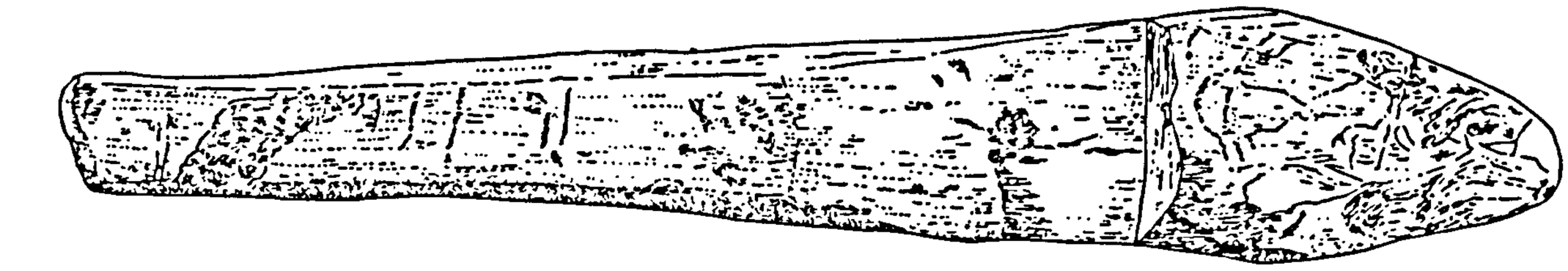
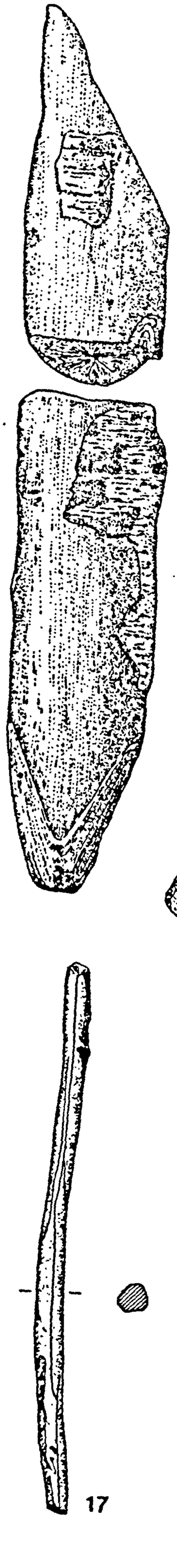


8

9

0 5cm

Fig. 30



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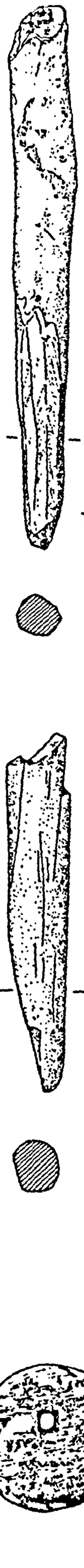

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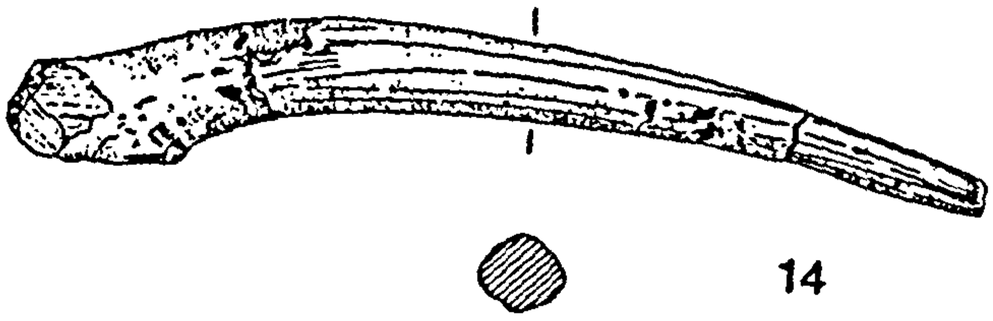

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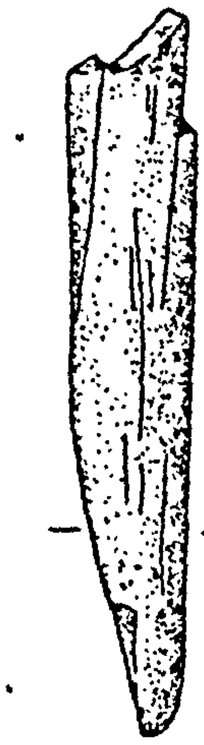

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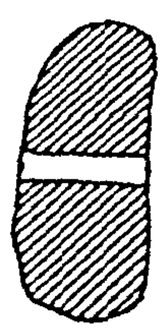

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Fig. 31

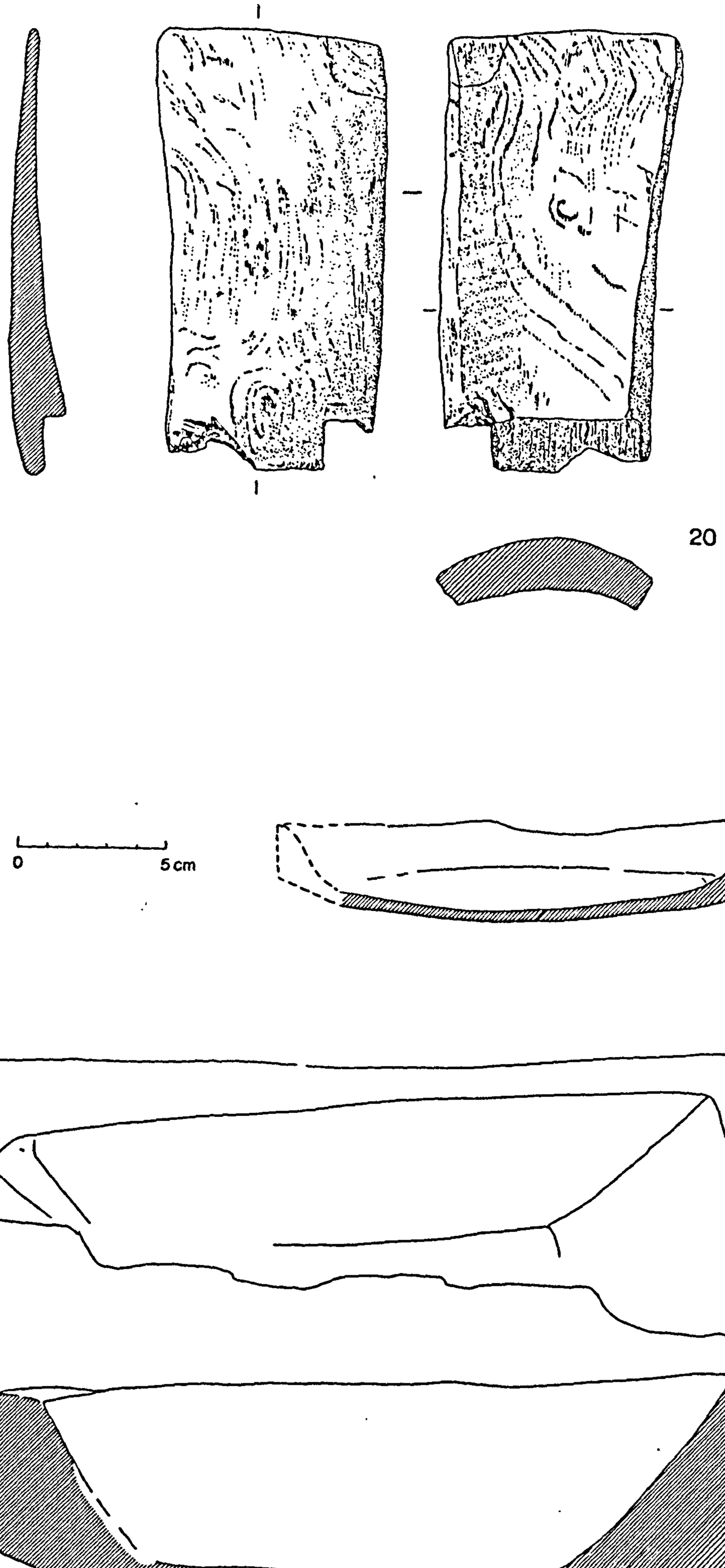


Fig. 32

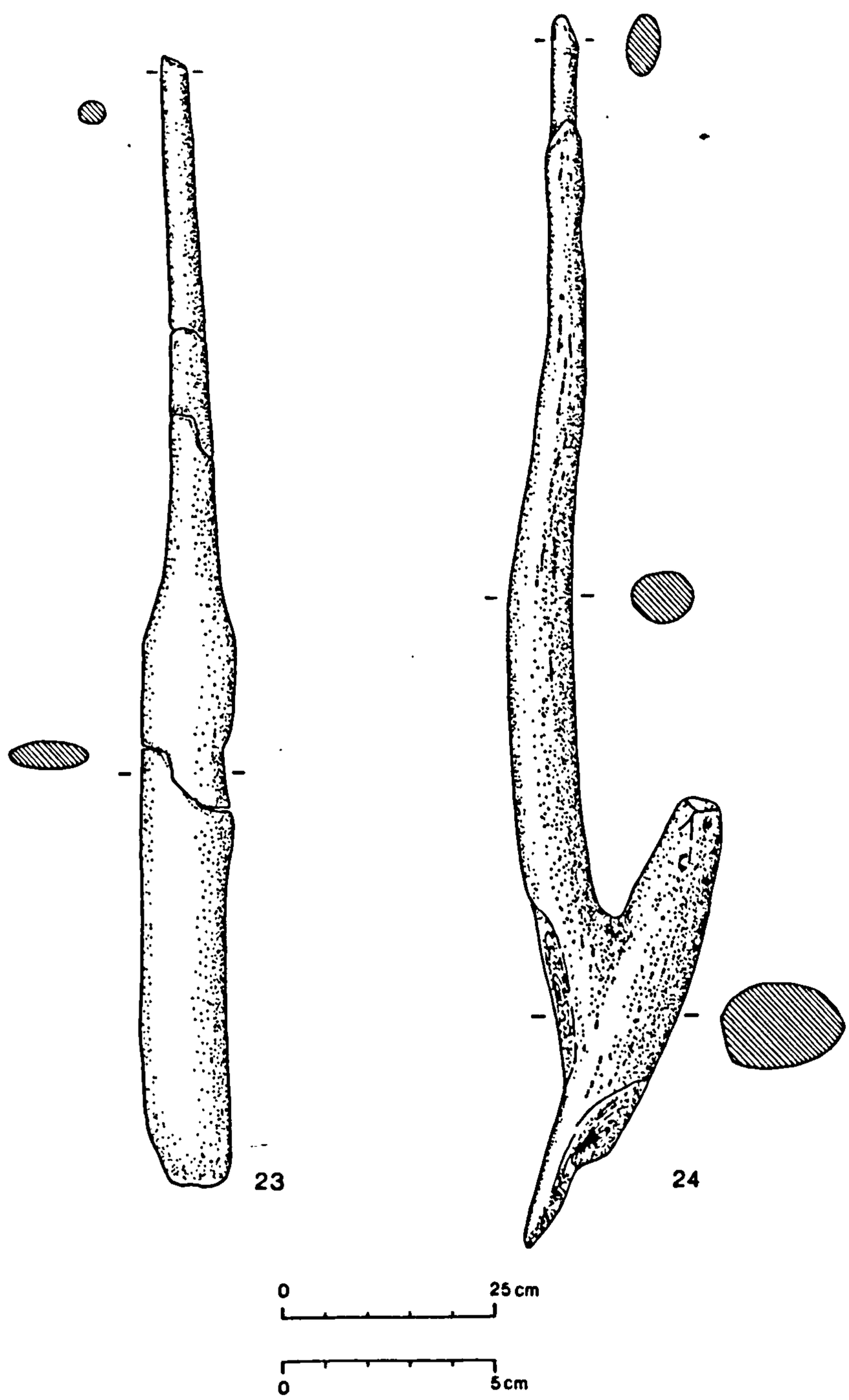
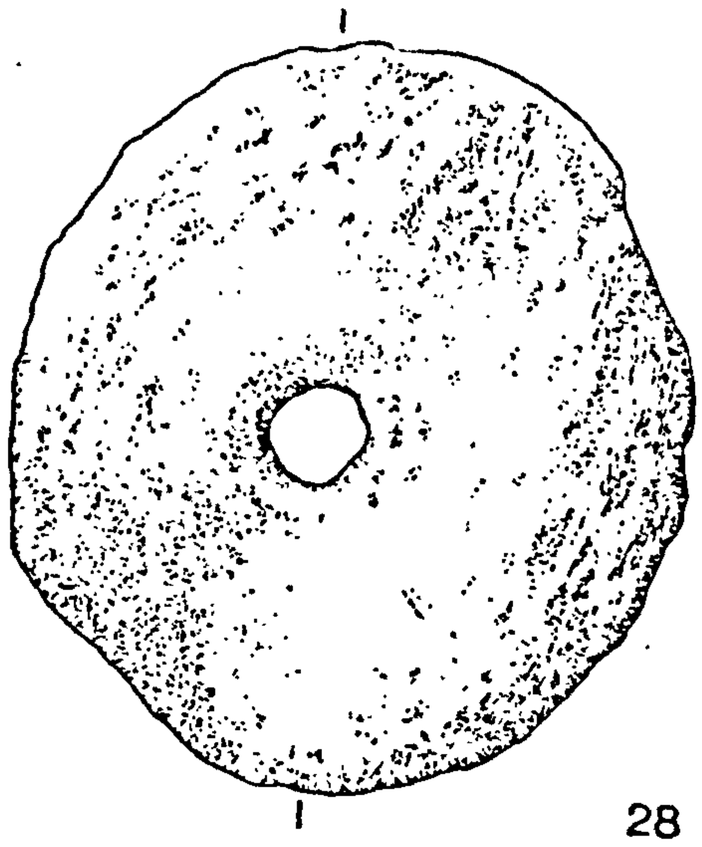


Fig. 33



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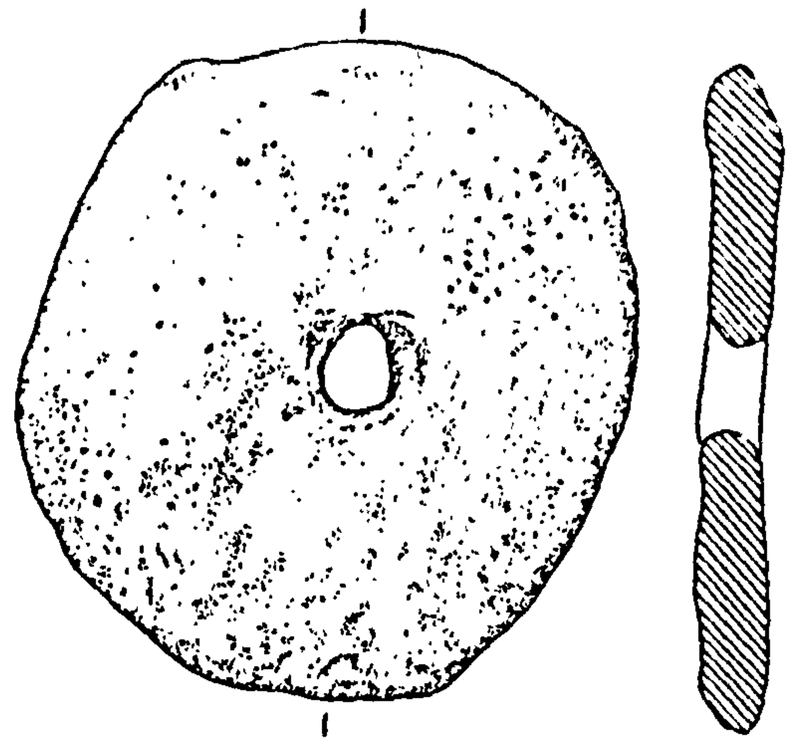

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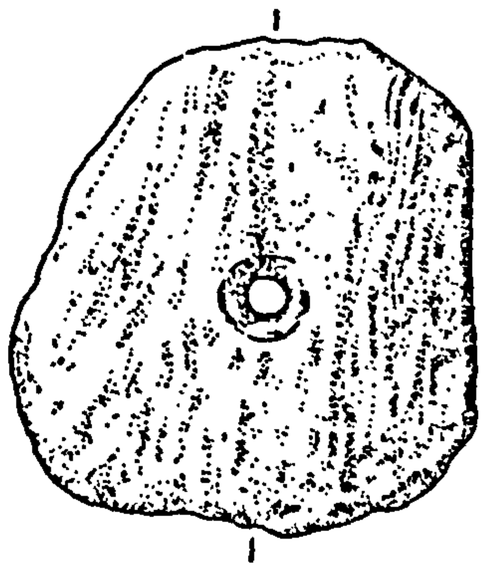

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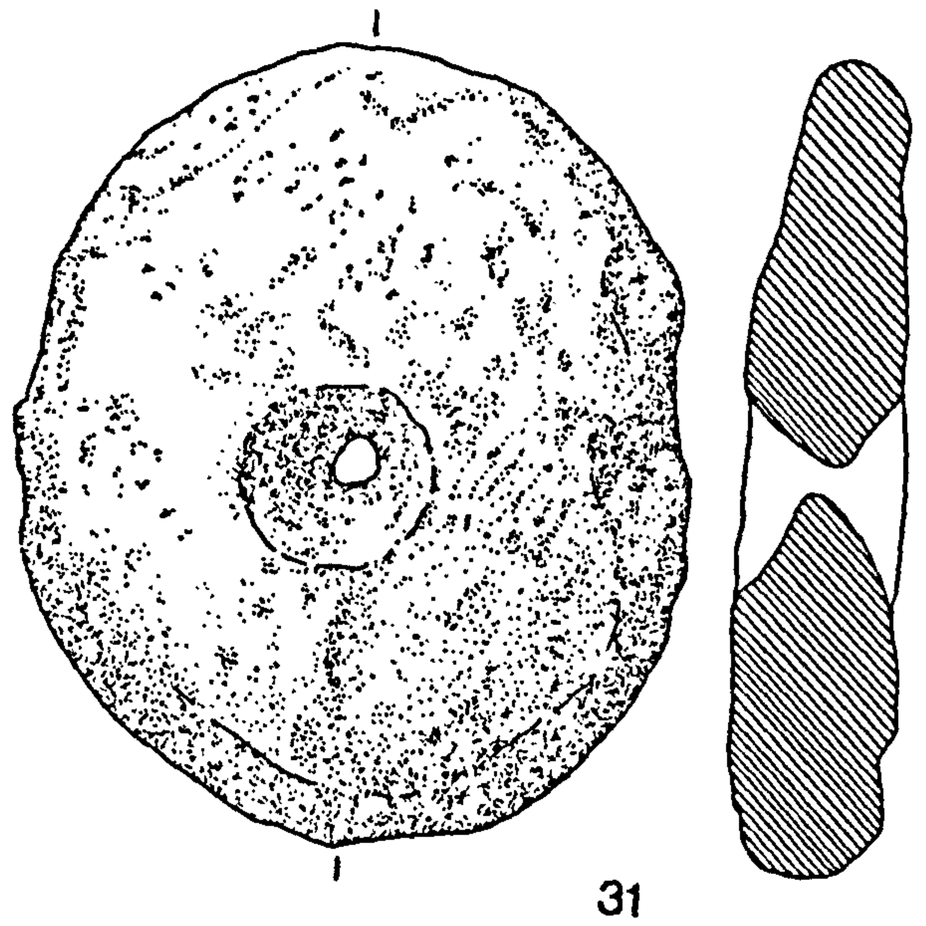

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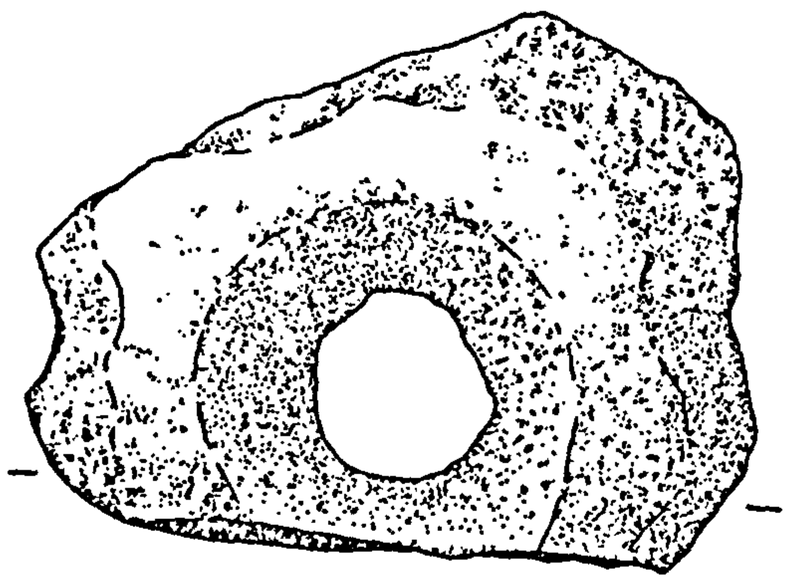

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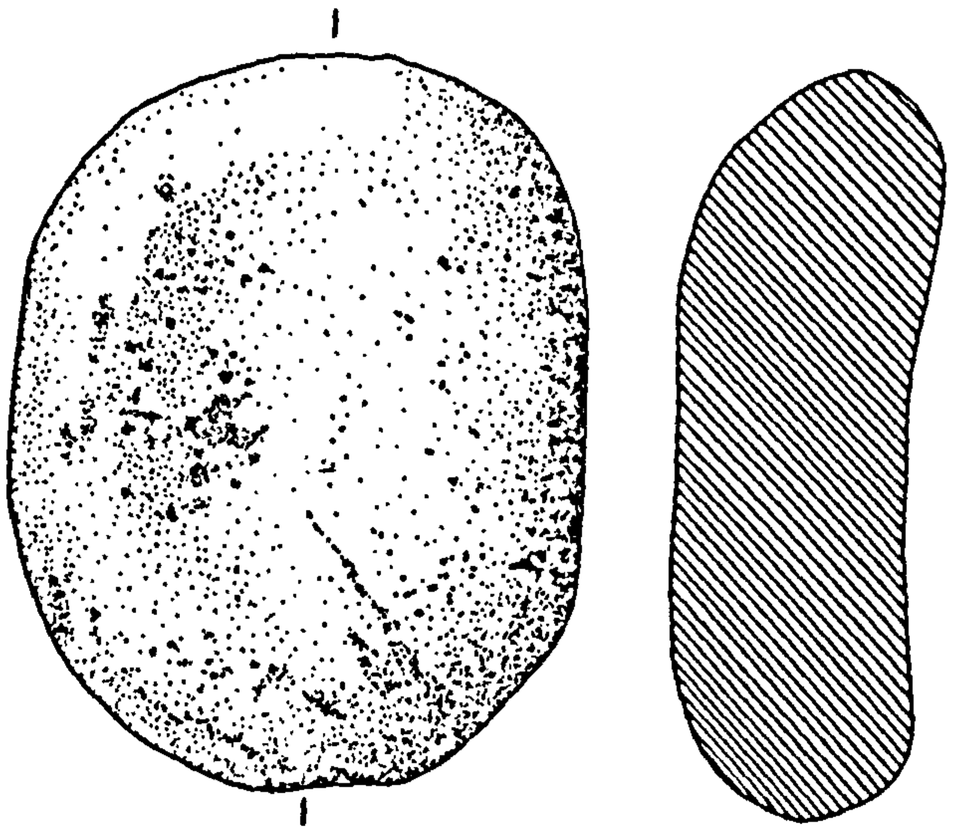

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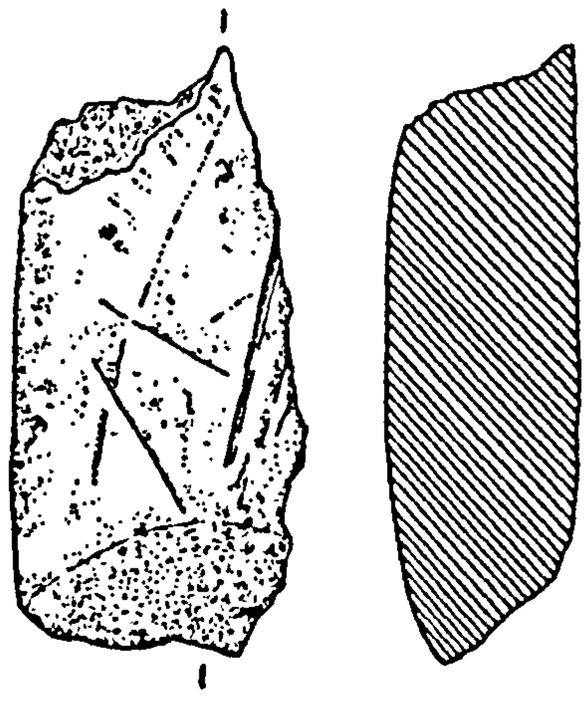


34

0 5cm

Fig. 34

blade near the handle may be where it rubbed against the side of a canoe but this is highly speculative and may only be a feature of the wood. Toolmarks are clearly visible on the blade. It is assumed that it is a paddle for a boat of some sort but it has been shown that similar implements were, and still are, used for winnowing and tilling the ground (Lerche and Steensberg 1971, 87 - 104). High concentrations of cereal pollen from the site point to the cultivation of crops but the use of canoes is also a certainty. Further examination of the surface of the paddle for signs of wear patterns may help to establish its proper function.

A find with considerable significance as evidence of arable cultivation by the crannog dwellers was that of a crook ard (pl 40. fig 33.24). It had been eroded from the exposed part of the excavated area by the winter storms and was discovered in the early spring of 1984. Since the erosion was localised the ard may be attributed to a location 1 - 1.5 m south-east of control point Q at a level corresponding to that of the lower floor-foundation timbers (F24. Fig 25). The ard is made of oak and it was not long exposed since the sapwood is still essentially complete all over except for a small area on the head (see pl 41).

Photographs of the implement have been shown to Dr. A. Fenton and Dr. S. Rees but so far neither of these authorities has had a chance to examine the object itself. However, both of them class it as a crook ard (as described by

scale 30 cms

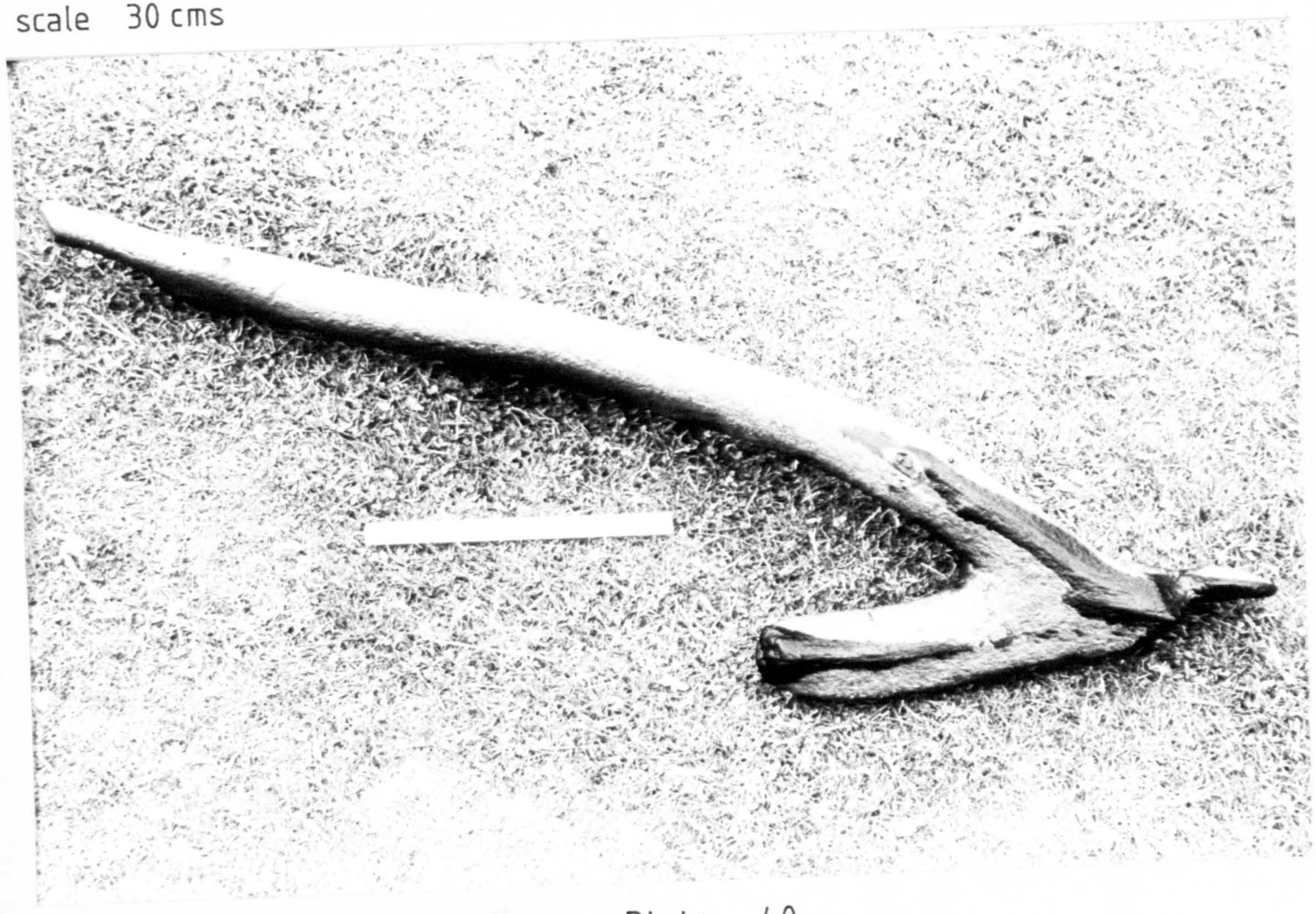


Plate 40

Glob 1951, 110) though as a type which neither of them was familiar with. An examination of the pertinent literature (eg Tools and Tillage 1968 - 1979, Glob 1951, Rees 1979) indicated neither illustrations nor descriptions of a similar type. The essential difference between the Oakbank ard and others of the crook ard type is clear. In the latter the share and beam are one piece, as in the Dabergotz ard (Bentzien 1968, 50 - 55) or the Vebbestrup ard (Glob 1951, 16 - 17), and the stilt and handle are separate and morticed into the top of the sole (see Glob 1951, fig. 2 for illustration). In the Oakbank implement the share and stilt are one-piece and there is no evidence of how the beam was attached, though use of a rope would seem to be the most likely method.

The direction of operation of the ard is indicated by a well-formed tang (pl 42) for holding possibly an iron share of the sort, illustrated by Dr. Fenton (1976, 255 - 258), from Ardnadam Chapel, Argyll. The one he illustrates is too large to fit the Oakbank tang but he also stated:

> 'In support of an early dating is the fact that an iron share of comparable form was in use in the 1st - 2nd century AD in South-East Scotland. This is, however, smaller than the Ardnadam and Swordale shares, though its form is parallel.' (Fenton 1976, 258).

The evidence from Oakbank may point to the manufacture and use of similar iron shares at a significantly earlier period. The tang is formed in such a manner that the sole of the ard beneath it presents solid oak heartwood where wear would be greatest in use

Plate 41

Plate 42

(pl 43). There is not a great deal of wear evident, particularly along the base of the sole where the softer sapwood might be expected to erode rapidly with use. A well-formed handle can be seen at the upper end of the stilt (pl 44) the maker having utilised a natural crutch formed by the wood.

As stated above, there is no clear evidence for the manner of attaching a means of traction to the tool. A rope around the base of the stilt where it joins the share would seem the most likely explanation but there is no clear indication of this on the surface of the wood though microscopic examination for evidence of wear patterns is yet to be carried out. It was initially considered that the tool may have been used as a digging implement in the same manner as the cas-chrom (Fenton 1974, 131 - 148 for consideration of the cas-chrom) but apparently the angle between the stilt and share is wrong for such use (Fenton pers. comm.) and the cas-chrom itself is a post-Mediaeval development.

The Oakbank ard is an important find which will be more fully considered in the future. It aptly demonstrates a number of important aspects of well-preserved finds from crannogs. In practical terms it shows the care taken to use a strong type of wood, to utilise the natural formation of the branches and to take full advantage of the attributes of different parts of the wood. It is evidence of the form of cultivation carried out and by association indicates to some degree the economic and social structure of the society. It also extends the range of known

Plate 43

Plate 44

cultivation implements and shows a greater diversity of type than has so far been seen.

Other finds of wooden objects are tantalisingly functional in their appearance but are so fragmentary as to be beyond recognition (pls 45 and 46). A substantial, apparently dressed, piece of oak with an arc cut from one edge looks like part of a yoke for draft animals (pl 47). A number of pieces of basketwork have emerged but all are fragmentary and do not indicate their original purpose (pl 48).

The most evocative find is a small whistle just over 5 cms long made of dogrose or cherry. At first sight it may indicate that not all the material is functional but the fact that it is a one-note whistle may point to a use for signalling or attracting attention. It does not now issue a note (pl 49. fig 31.16).

The crannog dwellers have shown considerable capability in woodworking. It is also evident that they considered the properties of different types of wood for specific jobs. Nineteen wooden pins have been discovered during excavation, of which sixteen were hazel, two were hazel or alder and one was oak. Most are 5 - 15 cms long and 1 - 3 cms in diameter. They displayed various degrees of cutting ranging between those with one simple angled cut to sharpen the end (fig 31.15) and those where facets cover the piece of wood and both ends are worked (pl 50. figs 31.11,31.14).

Plate 45

Plate 46

Plate 48

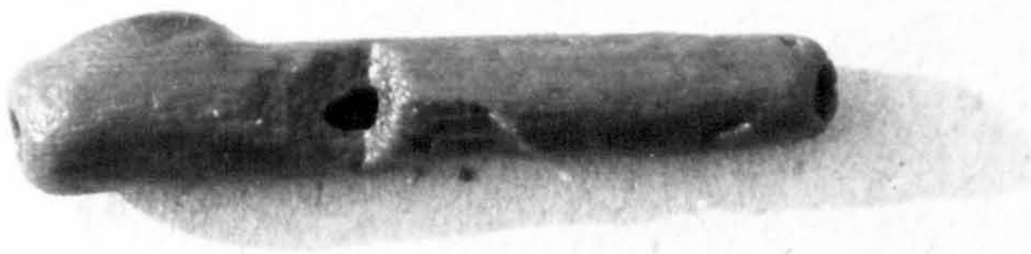


Plate 49

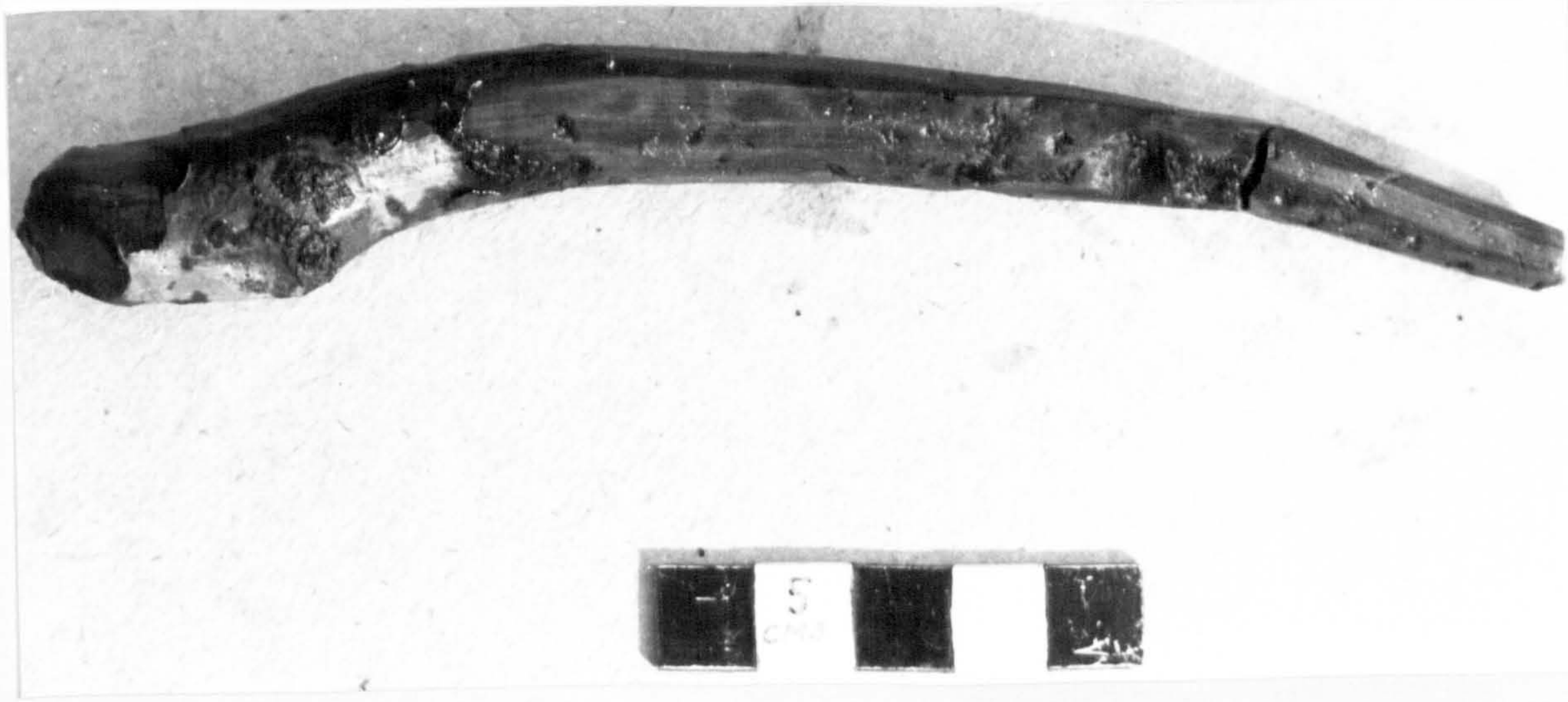


Plate 50

None was found in a position which might have indicated its original function but the possibilities are many. Leatherworkers would use such points for staking out skins during scraping. They could be used in weaving to fasten parts of the loom or the threads to the loom. They could be used for holding the hasp on a door or for holding hurdles or thatching in place. They would be used in rope making or for tightening loose joints in wooden structures. It is possible that future excavation may recover examples in situ.

That hazel was specifically selected for the manufacture of these points and not just utilised as the nearest wood to hand is supported by the fact that other types of wood were also used for specific purposes. Twelve splinters of roughly-split wood exhibited evidence of having been burnt at one end (pl 51. figs 31.17,31.18). They were from 3 - 10 cms long and had the appearance of tapers which is how they are construed. All except one, which was alder, were cut from pine, a resinous wood which burns well when dry. The resin would keep the taper burning even with a small flame. It is notable that in the list of more than 370 wood species identifications from the site, apart from the tapers, only one waste wood chip was pine (see Appendix C).

Of twenty-eight structural uprights which have been examined, twenty-two were alder, two were rowan, two were hazel and, interestingly, the largest pile sampled was elm. Proximity of supply may be more significant in this case where many large

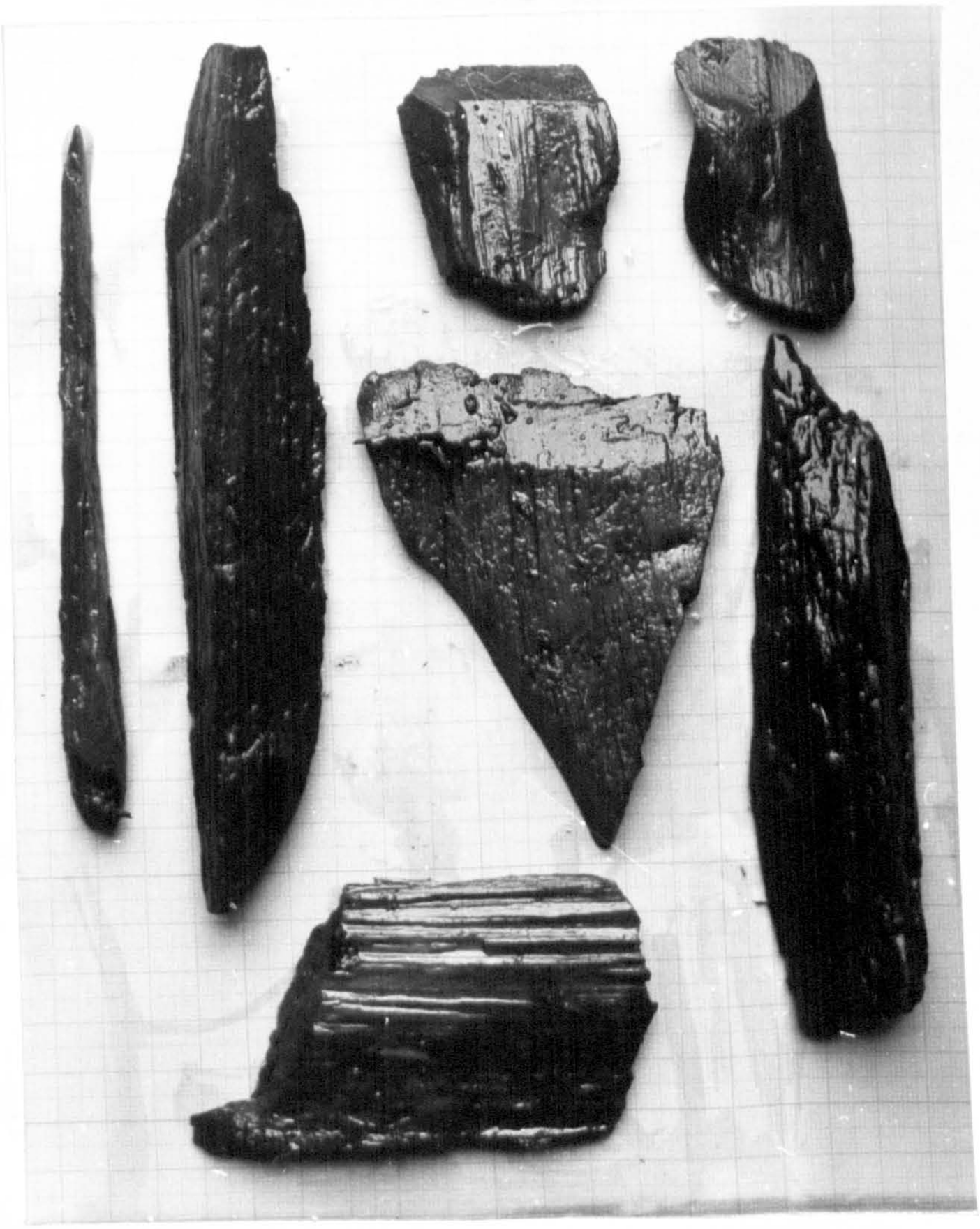


Plate 51

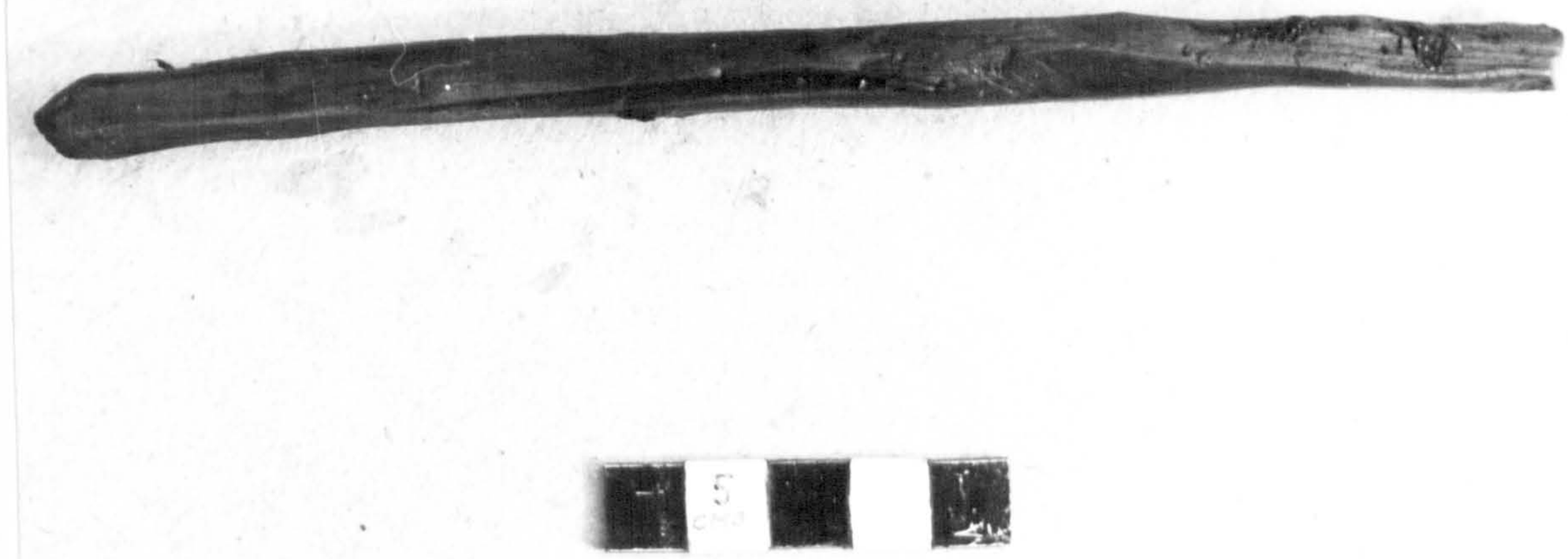


Plate 52

timbers were required but the importance of specific types of wood for specific tasks is reinforced by examination of the gangway pile stumps of which all forty are oak.

In many parts of the excavation chips of wood which were the residue of woodworking were encountered (pl 52). Forty-five were examined and identified. Twenty-nine were alder, nine were hazel, two were elm, 2 dogrose and one each of rowan, pine and elder. This accords well with the ratios of artifacts and structural timber.

11.1.1.2 Stone.

Of the substantial number of stones from the site very few showed conclusive proof of having carried out a specific function.

A group of roughly perforated stones c. 10 - 15 cms in diameter may have been used as net or thatch weights (pl 53. figs 34.28-31). They are subcircular with apparently little attempt made to shape them accurately and the only feature to show that they were functional is the hole in the middle. A smaller, but otherwise similar, stone c. 8 cms in diameter may have been used for the same purpose or may have been a loom weight (pl 53. fig 34.30). An even smaller and smoother perforated stone 4 cms diameter is an appropriate size to be a

spindle whorl (pl 42. fig 33.25).

The abundant tool marks on timbers throughout the site point to cutting with a range of sharp metal tools. So far none has been discovered but a number of stones has been smoothed or flattened and may have been used as whetstones, though only one shows clear ridging where thin blades or points were sharpened (fig 34.34). A large stone 40 cms by 18 cms is dipped in the middle and may have been used as a quern while other stones of various sizes could well have been used as hammers or rubbers but do not have conclusive wear patterns.

The most accomplished piece of stonework is a stone bead 13 mm in diameter with a neat hour-glass perforation not quite in the centre. It is probably from a necklace or bracelet and it is polished smooth (pl 42. fig 33.27). One jet bead or ring was found 25 mm in diameter with a large straight sided perforation through the centre (pl 42. fig 33.26). Marks of working can be seen in a few regular striations around the edge. These two objects make it clear that the inhabitants of the crannog had reason to care about ornamental belongings and, if they manufactured the objects on site, that they were as delicate in working stone as they could be with wood. If these were manufactured elsewhere the exchange mechanism by which they arrived on the crannog would be extremely interesting.

Plate 53

Plate 54

11.1.1.3 Pottery.

Remains of two pottery vessels were discovered. One was represented only by one sherd and the other by hundreds of fragments and some substantial sherds. The many sherds may be the complete remains of one vessel since they were all found in close association and the two largest pieces are joinable. Both pots were of similar fabric and were coarse wares with decoration in the form of string impressions around the shoulders (pl 54). Outside the clay is grey-pink but it is black on the inside. The fabric included very large quartz grits.

One of the most interesting aspects of the multiple-sherd find was noted when the pieces were allowed to dry. A black charcoaly deposit had been noted adhering to the rim sherds. On drying it began to shrink and crack (pl 54). Some of the sherds were immediately returned to water while the black deposit was removed from others. In some cases it was about 1 cm thick and upon analysis was proved by amino acid content to be the remains of food. It was not possible due to the high level of carbonisation to distinguish whether the food was meat or vegetable. The deposit was so thick and so carbonised that it may well have resulted in the pot being thrown out. It has not yet been possible to reconstruct the vessel and it is in so many and such small fragments that it may prove an impossible task. The remains were lying on top of the organic deposit underneath the upper stones and most likely relates to the later phase

associated with the boulder cover rather than the earlier organic matrix.

11.1.1.4 Metalwork.

It has already been stated above that no metal tools have been discovered yet on the site. However, the toolmarks on timbers of all sizes point to the use of such tools. Small pieces of iron concretion have been found within the organic matrix but they may be the result of natural dissolution of iron from iron-rich stones which are common in this area. Five pieces of slag have also been excavated and analyses of three of them have shown high levels of iron suggesting that metalworking was being carried out on site. Since these samples were from relatively low levels in the organic matrix they are likely to be nearer the earlier dated phase of the site which, if they are an indication of iron working, is an early date for such metalworking in Scotland.

11.1.1.5 Bone.

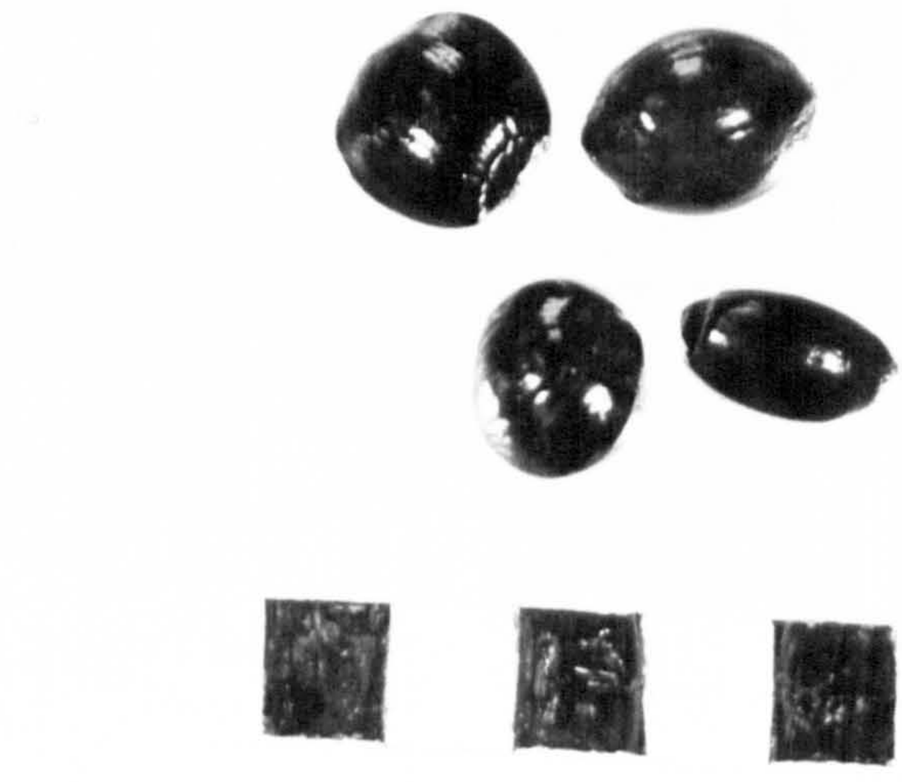
Other finds included scatters of burnt bone fragments in all parts of the site. The individual fragments were not large enough to be diagnostic. Unburnt bone, in contrast to other organic materials, was in a very poor state of preservation. The process of degradation is not known but the bone had the appearance and consistency of liver-coloured jelly in most cases and dissolved in the loch water when sampling was attempted. In the area excavated so far there was surprisingly little evidence of bone, the most common fragments being the jaw-bones and teeth of cattle and other animals. The teeth were in a better state of preservation than the bone (pl 55) though the cusps in the centre of the tooth structure often fell out as the soft material around them had deteriorated. So far the majority of teeth are those of cattle of various ages, with smaller numbers of sheep and pig. Wear on the pig teeth indicated both young and mature beasts (Appendix D).

11.1.2 Environmental Potential.

The largest group of finds from Oakbank Crannog falls, not surprisingly, under the heading of environmental material. Much of it indicates not only the environment in which the crannog dwellers lived but also the manner of their exploitation of that

Plate 55

Plate 56



environment. The range of trees, shrubs, grasses and cereals found on the adjacent loch shores is displayed in the materials used to construct and reconstruct the different elements of the site, the flooring and bedding on which the inhabitants and their animals lived and the food which they ate. The types of animals are indicated and the diets of men and beasts exhibited in preserved excreta. The excreta itself offered sustenance to insects and parasites which have been preserved in it and in the floor covering on which it dropped. The remains of Oakbank Crannog consist of about 1,000 cu.m. of this material of which only a very small area has been sampled and analysed. The reports of the studies which have been carried out clearly exhibit the great potential for future larger-scale research in this area.

11.1.2.1 Seeds and Macro-plant Remains.

In all parts of the site seeds and fruits, or parts of them, can be discovered . Individual examples are scattered everywhere but occasionally a group in close association is uncovered.

The most obvious type, because of their size and ubiquity, are the broken shells of hazelnuts and occasionally the whole nut (pl 56). On a number of crannog sites in Loch Tay and elsewhere hazelnut shells were observed around the base or on the flat top of the mound associated usually with evidence of other organic

remains in the form of timbers or vegetable debris. This supports the evidence of many references to hazelnut shells being found in substantial quantities on archaeological sites and presumably used as food since they are almost always broken. They were exploited as far back as the Mesolithic period and were ubiquitous on the Swiss lakeside sites, while as long ago as 1882 Munro commented, 'In all the lake-dwellings that have come under my own observation, the broken shells of hazel-nuts were in profuse abundance'(1882, 283).

Hazel is well-represented at Oakbank having apparently been used in several ways. As fodder for animals, food for humans and also as wood for artifacts (see above). It is quantitively second only to alder in macro-plant remains and is also well represented in the pollen record (see Appendix E). It seems that the nuts would have been consumed by the human members of the household and the foliage by sheep but apparently cattle are not fond of hazel leaves. A number of nuts from Oakbank were unbroken and in some cases holes were observed where insects had drilled through the shells. A sample when opened proved to be essentially empty except for a thin skin which was all that remained of the fruit. The same proved to be the case with wild cherry stones except that there were two empty thicker skins inside.

Wild cherry stones are almost as abundant as hazel-nuts on the site but since the fruit of the cherry is on the outside the stones are left complete. They were eaten as food by the humans but since the stones are not fragmented it would seem unlikely that they were fed to the animals. Few sweet fruits would be available to the occupants of the crannog and wild cherries may have been valued as such.

It is notable that cherry (prunus) is only minimally represented in the pollen record (see Appendix E). This may indicate that the foliage was not used as bedding or flooring and that it was not fed to the animals. It is also not represented on the site among the species exploited for their wood, with the possible exception of the whistle which may be cherry or dogrose. Although cherry trees are today found on the loch shore directly adjacent to the site, in antiquity they may not have been in such close proximity and may have required collecting from a distance if they were valued for food. This could also explain their absence from the pollen record.

During excavation of area B, between features F9 and F10, on removal of a layer of stratified compressed floor covering a deposit of substantial numbers of cherry stones was discovered. Unlike other material encountered the individual stones were buoyant and immediately began to rise to the surface of the loch. No difference was apparent between those and any other similar stones from the site except one which when gripped by the

excavator turned out to be complete with the flesh of the fruit. Unfortunately it was so fragile that the pressure of handling broke off the flesh leaving only the stone. It is possible that this enclosed deposit was better sealed than other parts of the site and that the buoyancy of the stones was a result of the gases of the rotting process being trapped in the shells. It was observed that when a surveyor's arrow was probed into the organic matrix and withdrawn it was followed by a number of gas bubbles. The gas has not yet been analysed but it may be methane which is given off by rotting vegetation.

A number of other seeds indicative of wild plant exploitation were recognised under laboratory conditions (App. F). A number of small samples had been taken from the top of the organic deposit in area B in 1980 by J. Stokes of the Institute of Archaeology. The examination of one of the samples was presented as a case study in a final year MA dissertation and the seeds in Appendix F were recognised. The samples were taken in 7 cms diameter plastic flowerpots and cannot therefore be seen as a representative fraction of the range of seeds from the site as a whole nevertheless the results indicate roughly the same situation as that shown by a more comprehensive core taken later for pollen analysis (Appendix E).

In the small sample the taxa identified are all seen as indicative of human activity in terms of land disturbance or as plants with food value. The Polygonaceae and Compositae are weeds associated with land disturbance such as forest clearance,

and particularly with the practise of arable cultivation, as are caryophyllaceae, chenopodiaceae, ranunculaceae and urticaceae. However, they should not be considered economically only as indications of cereal production since they are all edible, to one extent or another, in their own right.

For instance, Nipplewort (Lapsana communis) has been found in a number of Neolithic contexts in Europe and at Fifield Bavant and Vallhagar, Sweden in iron age contexts(Renfrew 1973, 173). Polygonaceae have also been recorded from archaeological sites including Itford Hill, England and at Ermelo, Holland where it seems to have been deliberately collected in the Early Iron Age (Renfrew 1973). It is commonly found with cereals and, as a source of food, may have been processed into flour (Renfrew 1973, 182). The foliage and possibly the tubers of umbelliferae, the parsley and carrot family, may have been exploited but the fruits of rosaceae in the form of rose hips, blackberry and raspberry would certainly have been.

Linum ussitatissimum, cultivated flax was represented in the seed sample and is a commonly recognised cereal of importance from as early as the fifth millenium B.C. in the Near East and at neolithic Windmill Hill in Britain(Renfrew 1973, 120). It is valuable not only as a source of food but also for oil and fibre. The development and uses of flax are well covered elsewhere (Renfrew 1973, chap. 15) and its importance is only noted here. Its exploitation is not established at Oakbank as it is only represented by one seed and is not seen in the pollen

record though polygonum persicaria, a weed particularly associated with flax, may point to its cultivation.

Cereal grains were not observed in this small macro-plant sample, and have not yet been noted anywhere on the site, but pollen analysis carried out on a part of the sample showed that 12.7% of total pollen, second quantitatively to gramineae (44.7%), were cereal types (see Appendix E). The low level of preservation of cereal grain is not surprising not only because it is a relatively soft type but also because it would be quickly eaten by insects and small mammals. The same argument applies to Gramineae seeds which were not observed in the sample.

The sample was also examined to establish its potential for useful studies of insects and phytoliths.

11.1.2.2 Insects.

Insect remains were recorded during the excavation of Oakbank Crannog. Parts of beetles, recognised as the dung beetle, were occasionally uncovered. They were readily recognisable as elytra, head, legs and mouth parts but many microscopic remains must also be present and have indeed been observed in the laboratory. The most common remains were the puparia of flies which were discovered in layers during excavation but were also recovered from the small organic sample (see Appendix F).

The action of other insects is indicated by tracks made on the sapwood of timbers beneath the bark (pl 57).

That initial examination of small samples has already yielded so much is hardly surprising because of the range of econiches within the structure of the crannog being so wide. Within the house would be areas with conditions dictated by functions such as cooking, storing, food proccssing, weaving and spinning, and a range of habitats from small dark corners to holes in the thatch. The materials related to these niches would attract particular vermin. Outside the house is the open walkway, and also no doubt a midden area, plus the large extent of the water/crannog interface. The range of environments available would have been the homes of many creatures such as spiders, woodlice, snails, worms and insects including beetles, flies, wasps and earwigs. The potential for examining this wide range of creatures in such a complete state of preservation and in many instances within the remains of their required environment is excellent and survives on few types of site available from this date.

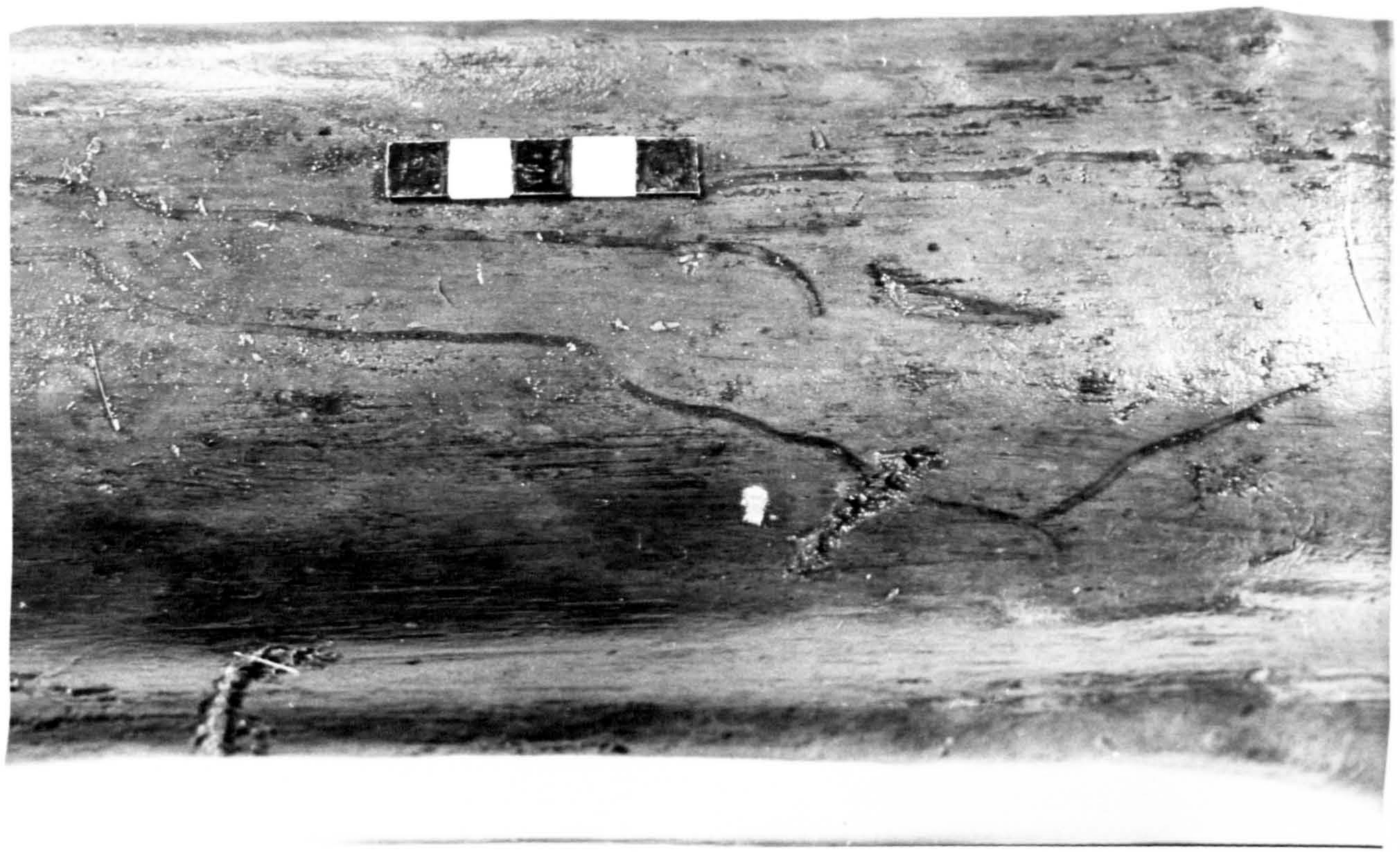


Plate 57

11.1.2.3 Phytoliths.

A phytolith count was carried out by J. Stokes to examine the potential for study of the grasses from the site (Appendix F). The material was available but could add little more to the record than the plants themselves. One area where phytoliths may prove useful is in establishing what fodder was preferred for cattle and sheep. The teeth of both types of animals are recovered (see above) and it is evident that on the outer surface of them the 'coating' is still preserved (see pl 55). This 'coating' is substantially made up of phytoliths extracted from the grasses by the masticating animals. Since a great deal of fodder must be consumed to build up a deposit the phytoliths should be highly concentrated and indicative of the main herbs eaten. Taken in conjunction with analyses of the faecal material a very accurate picture of herbivorous feeding habits at Oakbank should be possible.

11.1.2.4 Pollen Analysis.

The most substantial piece of environmental work carried out to date on material from Oakbank is the study of a core for pollen analysis. It was evident from the initial work of Stokes that environmental studies of seeds, pollen, insects and other material, such as phytoliths, was appropriate and rewarding.

Accordingly, in 1982, efforts were made to acquire a sample for examination that would be more representative of the different phases of habitation. A core was acquired by driving a 10 cms diameter plastic drainpipe through the site from the top of the organic deposit down into the loch bed.

The attempt was experimental in that it was not known whether it would be possible to penetrate the whole deposit without severe disturbance to the cored material and contamination of the sample or, indeed, whether it would be possible to penetrate the deposit at all due to compaction of the material or the likelihood of encountering boulders or hard timbers. Damage to concealed features and artifacts was also taken into consideration but the results which might be obtained from a complete core of the organic matrix were seen as justifying that risk. The experiment proved successful with penetration not too difficult and disturbance and contamination not apparent. The tube had to be excavated out but a piston corer would solve that problem.

The limitations of a single core are appreciated, particularly in the case of a site like Oakbank where many different functional areas are apparent. However, the exercise established that the technical difficulties are not great and that it should generally be feasible to take cores where and when required. It is hoped to carry out systematic sampling of the site in this way in the future.

Examination of the core taken in 1982 was carried out by Dr. R. Scaife of the Department of the Environment based in the Institute of Archaeology, London (Appendix E. fig E2). The bottom 12 cms of the core consisted of loch bed sands mixed with spores and pollen and the rest of the column represented occupation of the site. Scaife recognised two floor construction levels morphologically and in terms of recorded pollen taxa (fig E1). The upper floor was based 30 cms from the top of the deposit and is represented by a layer of sand and gravel 9 cms thick mixed with small stones. A waste flint flake was found in this material. The lower floor layer consisted of small stones lying on the loch bed and overlain by coarse sand and gravel based 78 cms from the top of the deposit and 20 cms thick.

The occupation layers overlying each floor are substantially organic material defined by Scaife as 'amorphous monocotyledonous debris' with high concentrations of bracken. The upper occupation layer contained substantial amounts of straw with wood at the top of the deposit and the lower occupation layer contained greater amounts of wood throughout and straw is not notable.

Scaife notes an unnaturally high proportion of spores to pollen in the basal deposit. Most of the spores are Dryopteris (ferns) with lesser amounts of Pteridium aquilinum (bracken).

An explanation of the high frequency of spores concurrent with the notion of a free standing crannog framework is proposed. If ferns and bracken were laid as flooring or bedding on a platform above water the spores and pollen from the material would fall through the interstices of the woodwork and build up on the loch bed. Over a period of time this would produce high concentrations until, eventually, the ends of the floor supports would rot and the floor with its overburden collapse onto the loch bed covering the area of concentrated spores. The rebuilding of the floor may have been achieved by extending the remains of the earlier, submerged layers above the water or the supports of the later floor may not have lasted as long as the early structure so the spore build-up would not be so concentrated.

Arboreal taxa in the basal deposit are dominated by pollen of alder and hazel with evidence of oak and elm. Pine and birch are also represented. Scaife sees this as indicating the vegetation of the shore with alder round the edge of the loch, as it is today, and hazel on drier ground. Alder/hazel domination of the arboreal pollen persisted throughout the period of occupation of the site.

It seems likely that even at this level hazel would have been exploited for its foliage as animal fodder and bedding, nuts as human food and wood for artifacts. The percentage of hazel pollen at this, and later levels, may then be distorted by

anthropogenic factors. If this is the case then the levels of alder compared to hazel in the landscape may be even higher than indicated in the pollen record. It is interesting that the name Fearnan, the village where Oakbank Crannog is situated, means 'the place of the alder'.

11.1.3 Dendrochronology.

The wealth of timbers on Oakbank Crannog is a useful reservoir of material for dendrochronological studies. Tree-ring researches relevant to the Oakbank excavation fall into two basic areas. Firstly, master chronology building in which a continuous sequence of dates from the present are projected progressively further into the past. A number of oak samples were taken from Oakbank Crannog by Dr. M. Baillie of QUB in the hope that they might correlate with master chronologies for Ireland. Most of the samples had insufficient rings for satisfactory comparisons (Baillie, pers. comm.) and apparently they did not match any part of the master curve but large oaks are still sought from the site with the idea of absolute dating.

The second area of tree-ring studies is where dates are related closely to a particular site or group of sites and are intended to add information of economic, social or technical interest to the site's history. The relative chronology of different phases of habitation and construction may be of greater

importance in such a case than the precise placing of the site in time in absolute terms. Useful results in this area of tree-ring studies were achieved from Continental lakeside sites and from the trackways of the Somerset Levels (see below).

Timbers with too few rings to be of any value in correlating with or constructing absolute chronologies have been shown elsewhere to be valuable in forming groups of timbers which were contemporary. At Baigneurs in Lake Paladur, France a sequence of house building and habitation spanning ninety years with a period of sixty years of abandonment between two occupations phases was distinguished by tree-ring studies. The site was dated to 2,900 b.c. by radiocarbon analysis and the settlers built the first house in winter having prepared some of the timbers the previous winter. Details of the occupation sequence were recognised with the use of dendrochronology for establishing the relative dates of timber groups on the site. At Baigneurs the sequence of occupation would not have been readily observed with other methods and even if it was archaeologically discernible the actual time periods involved would be a matter of speculation as radiocarbon dating cannot yet resolve such short time spans.

In the case of the Somerset Levels contemporary phases of track building have been established (Morgan, Coles, Orme 1978. Morgan 1976 - 1980, 1982, 1984). A chronology of 408 years was constructed using oak timbers from The Sweet Track (Morgan 1984, 49) and, although oak is the main species used for chronology building in Britain, a sequence of 162 years was built

from ash timbers (Morgan 1984, 57). Hazel has also been cross-matched and established the contemporaniety of Rowlands and Walton Heath Tracks (Morgan, Coles and Orme 1978, 218 - 220). Tree-ring studies have not only been used in the Somerset Levels for comparing the dates of trackways. Comparison of timbers from the Sweet Track demonstrated the practise of coppicing and woodland management as early as the fourth millenium bc (Morgan, Coles and Orme 1978, 218).

Archaeologically different phases of building or strengthening are apparent at Oakbank (see above Section YQ) with stakes being driven down from above but it is not always clear by visual observation which timbers seen in place relate to which of the proposed features (see above) or how features relate to each other chronologically. This would seem to be a case where site-specific dendrochronology may prove useful. The fact that distinct features and groups of piles are so readily discernible makes dendrochronology particularly applicable here. It is in the detailed distinction of where features start and end and their chronological relationship that the technique will prove most useful.

During the 1982 and 1983 seasons of work at Oakbank a large number of samples (> 250) were taken from timbers of all sorts, mostly alder, hazel and oak. The samples represent the structural elements of the site and are being examined by A. Crone at Sheffield University as one of two case studies for a Ph.D. thesis (App. C). Ms. Crone's work involves examination

in future of all the wood from the site in an effort to establish the woodland management practises of the crannog dwellers and includes species identification and dendrochronology. It is hoped that her research will help to clarify the relative time scales of the different groups of piles and features discussed above.

There is obviously a wide range in the size of timbers sampled at Oakbank (App. C) and many of the oaks, which are normally the most likely to produce a useful sequence, are relatively small. However, few of the large structural piles have yet been sampled. Also, most of the large oaks from F16 have still to be examined and the timbers from these groups may prove more productive. Cross-matching is difficult between different species but that it can be done with some success has been shown from the Somerset Levels (see above). The three main species at Oakbank are alder, hazel and oak and even if the oak does not have ring patterns long enough to construct a chronology the hazel and alder may together be useful as they have been shown to match elsewhere (Morgan 1980, 27). Crone's work has yet to show its true worth at Oakbank but it is apparent that good results are feasible. This kind of site-specific dendrochronology should in future be regarded as an integral part of the crannog work as it is in the Somerset Levels.

Chapter Twelve

Summary of Results of Oakbank Excavation

12.1 Structural Sequence.

The structure of crannogs can no longer be seen as a simple matter of either timber or stone as proposed by Munro. The evidence from Oakbank proves that underneath the boulder cover are the remains of a free-standing timber platform to all intents and purposes like those recorded in the south-west. In fact, the difference noted between the two different types is seen at Oakbank as a result of later builders having to build on the remains left by those who preceded them. The first builders chose a flat sandy area of the loch bed on which to build their crannog no doubt taking into consideration the topographical requirements of the shore and loch bed as discussed in Chapter 8. The area had no obstructions to prevent the siting and driving of timber piles and the erection of the major structural framework. The superstructure was obviously tailored to their requirements for domestic, agricultural, craft industry and other uses.

Indications from Oakbank are that the inner floor area of the site would be on a platform suspended over the water. Eventually, through the rotting of the ends of the platform joists and the weight of occupation debris the centre of the site would subside and collapse onto the loch bed. Whether this process would be abrupt or would happen slowly is not yet known but that it did take place is attested archaeologically at Oakbank. It seems likely that although some of the surrounding piles would require strengthening or repair the majority would still be strong support when the floor joists collapsed and may have endured a number of floor rebuilds.

Further occupation of the site would require that the living area was raised above the water level and this may account for early records of layers of brushwood, earth and stones (Stuart 1865, Munro 1882, Keller 1866). At Oakbank there is so far no indication of such disparate layers and the evidence points to a gradual deposition of basically homogeneous materials. This is seen in the section Y-Q (fig. 27) and in the results of pollen analysis which, although showing two floors overlain with small stones, presents a general matrix of organic material. It is possible that the sinking of the living floor as the joists degraded was relatively slow and that as the floor developed wetter areas they would be covered with brushwood. Eventually a stage might be reached in which all the joist ends were rotten and the inhabitants were occupying a floating, but slowly sinking, raft of material. Relative stability would again be

reached when this organic mass settled on the loch bed.

If after this stage is reached the crannog-dwellers continued to occupy the site the submerged mass of organic material would be a stable base for the superstructure and would still allow uprights to be driven into the deposit for the renewal of walkway, stockade and house-wall supports. The living floor would have reached a stage of development which required only the normal occasional renewal of floor covering since subsidence would be at a minimum and the underlying base material would be protected from degradation by the anaerobic and polyphenol-high conditions under the water.

In this state no situation can be envisaged which would require large boulders to be deposited over the site. In fact, since the organic base of the mound has been well-preserved to the present time as a substantial mound it may be presumed that the inhabitants of the site could have utilised it for as long as required. However, at some point the site was abandoned and long enough for substantial upright timbers to erode down to the surface of the organic base mound. In Loch Tay the piles of piers over a hundred years old are still standing above the water level so it is possible that as much as two centuries or more would be required for the state of degradation noted at Oakbank to obtain.

It was apparently only when this stage had been reached, when the projecting timbers of the structure had rotted and the site was either submerged or very close to it, that the layer of large boulders was deposited both on top of the mound and around the edge, though the two are not necessarily contemporary. It seems reasonable to assume that they were intended to raise the top of the site to a functional height above the water. What that function might have been is not clear but it is difficult to see boulders as an appropriate foundation for a substantial timber structure. If that had been the purpose it would surely have been more useful to drive new upright timbers into and around the existing mound and proceed much as their predecessors had done.

That a timber structure did exist which was most probably associated with the boulders is seen in a few stake points driven 10-15 cm into the top of the organic deposit (pls. 58 and 59). The eroded upper ends were slightly proud of that deposit and appeared to have eroded rather to the level of the top of the thin layer of silt and grit. Since this layer is probably detritus from the upper boulders it must have formed while the stakes still stood and after the stones were placed. It may be indicative of a relatively insubstantial structure that there are only six of these small uprights and, so far, no large timbers associated with them have been found.

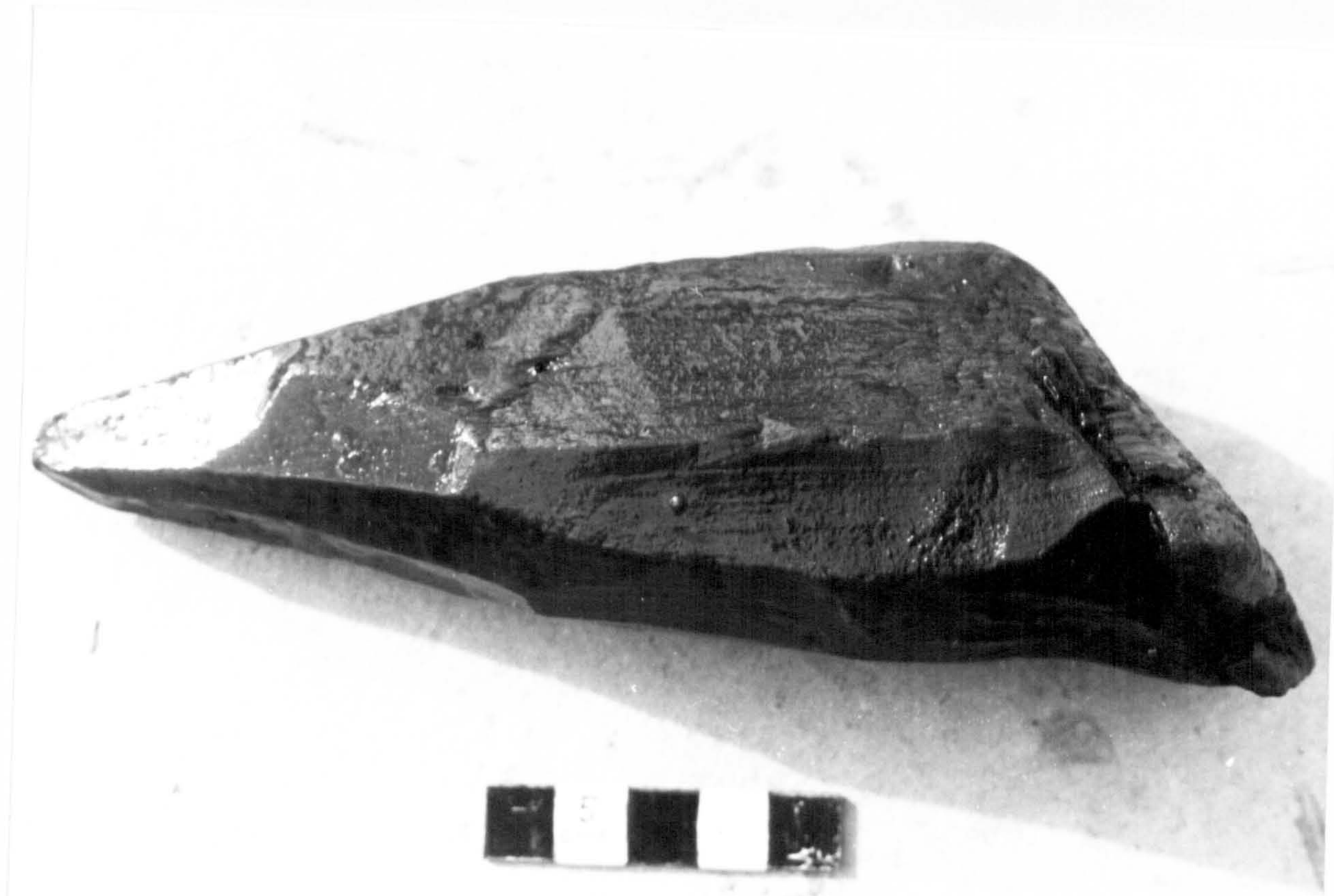
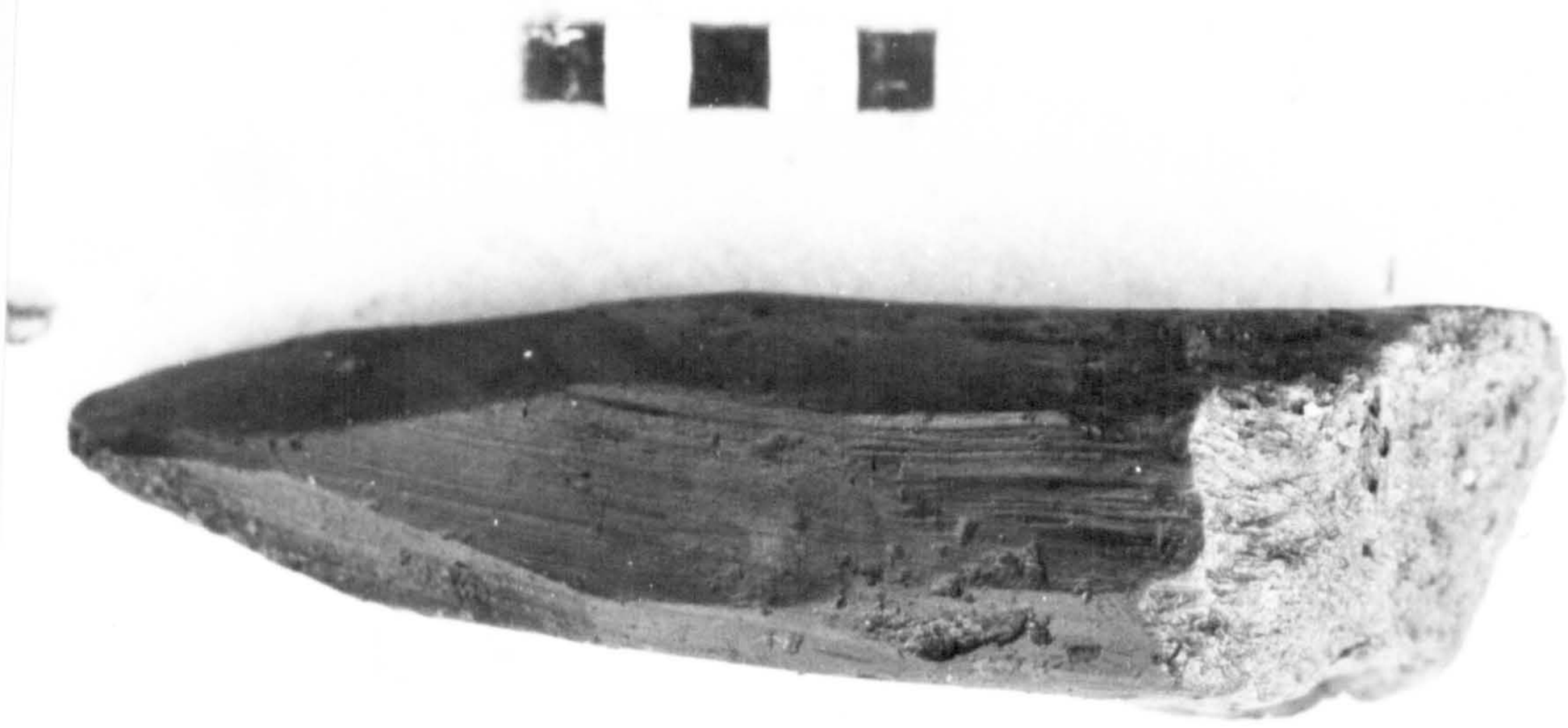


Plate 58

Plate 59



Whatever the size of the timber structure associated with the covering stones the rebuilding phase itself was apparently substantial since a radiocarbon date from a timber close to the west extension (fig. 15) suggests that it was contemporary with the small stakes. Thus, not only was the main mound rebuilt but a new extension, possibly in the form of a jetty, was added to the west end of the site. Possibly a similar structure may have existed here in earlier times. The timbers of the gangway have not so far been dated and it would be useful to know whether it was contemporary with the jetty. If the gangway relates to the earlier timber phases of the site and was abandoned and fell derelict at the same time this could explain the construction of the jetty as a means of landing canoes or boats for contact with the shore. The implications of considering the site with and without a gangway are of importance with regard to the agricultural history. A gangway would obviously facilitate the movement of animals to and from the crannog while canoe transport would make it much more difficult, although larger rafts may have been available. A move away from stock-keeping to a greater reliance on arable agriculture may be indicated or possibly more peaceful conditions were allowing the beasts to be kept in permanent structures on shore.

If a timber structure, with firm piles driven into the underlying material, did exist above the layer of boulders it would have had to lie within the circle of the peripheral stones since uprights could not have been driven through such a deep

layer. Since the upper layer is one stone deep in a relatively restricted area centred on the present excavations it suggests that a large part of the mound presented a bare boulder working area or that it was overlain with some other material which did not include substantial uprights. It is possible that branches or brushwood were laid down and that after the site was finally abandoned this material was washed away. Other alternatives would be earth or peat which would also erode away after occupation ceased.

However, it may be that the remains of large piles related to this layer have not been included in the excavated area. Two further points deserve consideration in this discussion. Firstly, since the boulders are more than a metre underwater they could never at that depth have been used as a floor surface. So, unless there has been a substantial change in loch level, they are still anomalous. The reason for laying such a layer under water is not clear as it would inhibit the erection of a timber superstructure. But evidence which indicates such an upperwork is seen in the remains of forty alder piles in the loch-bed surrounding the jetty remains. If they did not support a wooden platform then their use is unknown since they are sufficiently far from the extension boulders that they could not have been a containment for them. The above sequence of occupation is, of course, hypothetical at this time and may be proved or disproved by future excavation.

From the above it can be seen that stone-built mounds may not be a distinctive type of structure. In fact boulder covering may well have been a later method of rebuilding earlier sites which had become derelict. It is questionable whether a crannog built entirely of boulders would have been functional given the difficulties of constructing a timber dwelling on it. The idea that stony mounds restricted to the highland zone were 'mere shapeless cairns' (Munro 1882, 242) is no longer tenable and it is probable that many, if not all, of the stone mounds mark the organic remains of earlier timber framed sites.

One point arising from the above discussion deserves comment. If the hypothesis explaining the sequence of building phases and the deposition of the main organic matrix is reasonable then the depth of the top of that matrix below the surface has to be explained. It may be fortuitous that erosion took place to that depth before the laying of the boulder cover arrested the process. However, it might also be that the water level was lower in the past. There is, so far, little independent evidence to suggest this but it is notable that the boulders forming the shoreline adjacent to the crannog slope gently down from the shore before dropping sharply about 1m to the sandy loch bed. Where the drop-off occurs the gentle slope is virtually the same depth under the surface as the top of the crannog. This may represent an ancient shoreline and further research into the problem is planned in the future. Such a change in water level would also help to explain the submergence

of other sites in Loch Tay.

12.2 Building Phases.

The number of times that Oakbank crannog was rebuilt or strengthened has not yet been clearly established. With the excellent preservation of timbers it should prove a relatively simple matter to establish construction and occupation phases according to the evidence so far, and it is possible already to make certain inferences. It has already been stated above that dendrochronological analysis may eventually identify distinct groups of timbers and work is going ahead at Sheffield University in that field of study. However, a sequence is already seen in the site stratification which suggests that at least four building phases occurred.

The first phase is represented by substantial piles driven deeply into the loch bed standing approximately 2 m apart. Two of these uprights can be seen in the section (fig. 27) and the tops of others from the same group are inferred in area B (fig. 25) including the pile (103) which supplied a date of 595+55 bc (GU-1323). If the date is accurate and if the pile and the group to which it belongs, by inference, is the earliest structural phase, then the original constructors lived at that time. This date coincides with an anomaly in the calibration curve which according to Clark could place it as early as

800 BC.

The latest dates from the site are those from the two small stakes discussed above and the timber from the loch bed adjacent to the jetty. These range from 460 bc+60 - 410+60 bc uncalibrated and 510-450 BC calibrated according to Clark. Although there is no archaeological evidence for structures later than the small stakes on the main mound it is possible that later phases did exist and have been completely destroyed. This could not reasonably apply to large timber-framed structures which relied upon deeply-driven piles for stability. Evidence of such piles would still remain in the loch bed or the crannog mound.

Between the two phases dated to the eighth and fifth centuries there is archaeological evidence for two other construction episodes in the form of piles driven into the organic deposit to varying depths. These are best seen in section (fig. 27) but other uprights relating to the later of these two phases were also seen elsewhere during excavation. In the section a substantial stake point (497) (fig. 27. Pl. 33) was seen embedded in the organic matrix to a depth of c. 65 cms. The diameter of the timber suggests that it was part of a considerable rebuilding phase and this is supported by two other large piles, numbers 2 and 77 in area B, which appear to have been driven in to about the same depth though neither of them has yet been removed by excavation (fig. 25).

The level of these timbers correlates well with the upper floor recognised in the pollen sequence (fig. E2) and with the floor timbers and partition wall stakes of features F17 and F7. They may thus have been erected as part of the same work indicated by wood-chips and cutting debris lying on the lower layer of branches F24 (fig. 26). The implications from this group of material are that this was a substantial refurbishment of the site with replacement not only of the living floor but also of major upright supports. In the same group of materials would be the large structural oak timbers, F16, representing elements of the entrance superstructure, which were embedded to roughly the same level.

From the above evidence it may be inferred that the primary piles from the first construction phase were beginning to weaken and that a relatively long period of time had therefore passed since their erection, given that substantial piles will last in Loch Tay for 100 years or more (see above). Since there is no evidence archaeologically or in the pollen sequence of a period of abandonment between the earlier occupation phase and that just described the likelihood of permanent habitation of the site for a number of decades is reasonable. The impression given by most writers in the past is that crannogs were at best semi-permanent habitations and in many cases were merely occasional refuges. While this may have been the case particularly in the mediaeval period the evidence from Oakbank, by stratification and pollen analysis, strongly points to permanent habitation over

substantial periods.

Between the major reconstruction and the primary construction there is evidence for an episode when the site was strengthened. This is seen in the section by timber (349. Fig. 27) which penetrated the organic debris but was not driven to a useful depth into the loch bed. It is unlikely that this timber could have been forced through the depth of the organic matrix as it now stands and the cut-marks forming the point suggest that the mound was 30 - 40 cms deep when it was inserted. This may indicate that it relates to a time when the first floor platform had collapsed and when some of the uprights with less lateral support may have been displaced. There are in this area more uprights than elsewhere in the excavation and many of them (eg 493, 499, 495) slope out from the centre of the site (fig. 25) as if displaced by internal pressure. Events relating to this strengthening phase and the forces acting upon the site in this area are still speculative but it is hoped that future excavation will clarify the situation.

The relative chronology of the structural phases outlined above cannot at present be closely defined and must await more radiocarbon dates, dendrochronological analysis and excavation. However, as in the sequence of structural events some inferences can be made at this point though it must be reiterated that the evidence for the actual time scales involved is based on cursory observations of rates of timber decay. The figures given here are thus intended only as provisional indications and suggestions

as to the relative lengths of the periods involved. In summary the four recognisable phases may be outlined:

1. The first construction on the site consisting of a free-standing timber framework supporting a living platform on which was probably a round house, surrounded by a walkway and probably with a gangway to the shore. This phase may be seen as lasting until the platform joist-ends rotted and some displacement of upright supports took place, covering in all up to fifty years.

2. Some strengthening of the site by the insertion of more piles and a continuation of habitation debris deposition may have gone on for as much as another eighty years by which time the large primary piles would be considerably worn and weakened.

3. A considerable reconstruction phase followed with no evidence of a preceding period of abandonment. This involved erection of substantial peripheral piles, a new floor and a partition to screen the interior. Two layers of upper floor timbers are embedded in compacted organic debris, but overall there is less of a deposit than in the previous occupation. Thirty years accordingly might be conjectured for the length of habitation of this phase.

4. The site was then abandoned long enough for all of the uprights to erode down to the surface of the organic matrix and for the upper floor timbers to erode flat. According to the evidence of pier piles now in the loch this may have taken 150 years or more after which time the site was again rebuilt. Small stakes were inserted into the top of the mound and the site was covered with boulders. A jetty may have been added on the west side at this time suggesting that the derelict gangway was not rebuilt, though a jetty may have existed here throughout the life of the site. The duration of this and subsequent re-occupation cannot be conjectured since the exposed timber superstructure, if any, and any habitation debris no longer exists. The latest indicators which may relate to this phase are dated to the beginning of the fifth century bc. No evidence has yet been discovered to suggest that the site was occupied after that time.

Although highly speculative the above outline is a reasonable division of the 300 years from the eighth to the fifth centuries, indicated by the radiocarbon dates from Oakbank, according to the observed stratification. Of course the recognisable layers within the organic build-up do not represent almost 200 years of occupation as periodic mucking-out must have taken place to prevent too great a depth of material on the floor. The complexities of defining this layering have not yet been tackled but pollen analysis, possibly with samples taken as

close as every centimetre through the deposit, would seem the most effective method in conjunction with detailed observation of definable horizons.

The structural techniques and building sequence at Oakbank have been outlined above and are based on the evidence derived from observations of timbers and the sequence of deposition on the site. Certain inferences can also be made about the way of life of the crannog-dwellers and their relationship with their environment.

12.3 Farming.

A significant part of the evidence points to the inhabitants of the crannog as farmers thus reinforcing the same supposition by Munro and the evidence from earlier excavations. At Oakbank pollen analysis indicates cereal cultivation and the discovery of the ard shows one way in which the ground was prepared. High concentrations of cereal pollen (fig. E1) suggest that crop processing, such as winnowing, may have been taking place on the crannog and this is supported by an examination of animal faeces which showed no sign of cereal having been digested, though the sample was admittedly small. This might have accounted for the high concentrations and since it does not then processing on site is a likely explanation. The pollen and seeds from a wide variety of weeds of cultivation and other plants probably exhibit

their exploitation for food and possibly a range of as yet unknown uses which might include dyeing, medicinal and ritual functions. The evidence of cherry stones in abundance on the site and the absence of pollen and wood of prunus may also indicate that certain wild plants were afforded special protection or even cultivation.

Stock-keeping is well attested by the remains of sheep/goat droppings, obviously in situ, on the site, and the teeth of cattle, sheep/goats and pigs. Bone is badly represented on the site since it has decayed to a jelly-like consistency and dissolves in the water while it is being sampled. The material which has been examined is covered in Appendix D with the teeth and burnt bone report. The sheep were present on the crannog and possibly cattle and pigs as well according to faecal evidence. Whether they were taken in each night, were wintered there or were just slaughtered on site is not yet clear. The balance between cereal cultivation and stock-raising cannot yet be ascertained but will be monitored in future work. The animals would yield hides, horn, bone and wool as well as meat, blood and milk for food. However, the only evidence for exploitation recognised so far is a wooden spindle whorl which was presumably used for spinning wool.

Most of the area excavated so far is not likely to be where such items as looms or other craft furniture would be sited nor is it the best area for storage. These would be away from the entrance in the part of the site so far unexcavated and

recognition of these specialised working areas may supply better evidence for the produce and processes of agriculture.

12.4 Craft Industry.

There is no sign at Oakbank of organised industry for the purposes of trade or outside profit. The activities carried out there, except for agriculture, were probably related closely to the requirements of the inhabitants and might be classed as craft or domestic industry. How far agriculture was developed with a surplus in mind, or if it was intended to supply only the needs of the crannog-dwellers, may be clearer in future.

The most obvious industrial activity comes under the general heading of woodworking but encompasses everything from splitting pine tapers to the cutting of large piles. Regrettably the evidence for joinery techniques is only minimally represented, so far, by the remains of a few mortices and one possible mortice and tenon (see pl.28). Sophisticated techniques of jointing may be implied by the number and complexity of timbers on the site which in many cases must have terminated in mortices or tenons or other types of joints to hold the whole structure together.

If skilled work is implied it was utilised in conjunction with an economy of labour implicit in the use of the natural shape of the wood and the use of cutting only when necessary. There is no evidence for bark having been removed from the outside of piles (eg pl. 60). A number of structural timbers have naturally formed crutches left at one end which presumably supported lateral timbers associated with a roof structure. The large size of some of these suggests a strongly built roof. One of these timbers had two crutches at one end and the remains of a mortice at the other indicating a complex function. This economy of cutting is even seen in small wooden points which have been well-formed but still have the bark where no shaping was required (pl. 61). In many cases timbers appear not to have been dressed at all, for example the layers of floor timbers were only cut to length and had side branches removed.

When required fine cutting was also practised as demonstrated by the small circular plate, the bucket stave and the whistle. Whether there was more than purely functional motivation in the production of any of the objects produced for use by the inhabitants may be established by examination of a wider range in the future. There are considerable aesthetic differences between the plate and the coarse dish which were found near each other but the difference may be related to function. The whistle is the only wooden find so far unlikely to be a purely utilitarian artefact. However, the jet ring or bead and the stone bead are from necklaces or bracelets and were

Plate 60

Plate 61

almost certainly items of personal adornment.

Basket making is represented by a number of finds which show various methods of construction ranging from a sort of rope twisted from single withies to interwoven stems and strips of wood. Spinning is shown by the wooden spindle whorl and wool itself may be preserved elsewhere.

As noted in Chapter 11 the remains of at least two pottery vessels are represented in coarse sherds and one was a cooking pot according to the remains of burnt food adhering to the rim. They may have been produced near the crannog since it is unlikely that a large scale process involving messy material and substantial heat would have been carried out on the wooden platform. Fabric analysis by neutron activation has been carried out on a sample of sherds and it is intended to sample local clay sources for comparison.

No metal objects have been found at Oakbank but a few small pieces of slag when analysed showed that metalworking of some sort was being carried out on site or close by. The slag contained evidence of rapid chilling. Growth of an iron silicate and iron/titanium oxides indicated iron working. Since the slag was found at upper and lower layers it cannot be directly associated with one particular phase of occupation but its position in the organic matrix shows that it was being worked in the pre-boulder period. The introduction of iron into Scotland is a subject about which little is known at the present time and

the Oakbank evidence suggests early use.

A number of objects of flint and stone were examined by Mr. J. Kenworthy of St. Andrews University (see Appendix G). They are mostly undiagnostic and point to unspecialised working during the life of the site in some cases and the acquisition of objects used at a period earlier than the site in others. The two pieces of highest quality are part of a plano-convex knife and a broken barbed and tanged arrowhead both best related to the early Bronze Age and probably collected as curios. Four other pieces of flint have been roughly flaked and were possibly made and used on site. There is no evidence that flint working was of more than a cursory nature and since iron working was taking place would have been of relatively little importance.

12.5 Conclusions.

Although only a small area of Oakbank crannog has been excavated so far already a substantial amount of information relating to the occupants and their way of life has been gathered. Detailed analysis of pollen, seeds, insects and the other components of the organic deposit in conjunction with accurate recording and interpretation of the larger elements of the site are required if the maximum benefit is to be derived from the well-preserved material. Complete excavation of Oakbank in the future and the subsequent excavation of other crannogs in

Loch Tay and elsewhere will substantially clarify the way of life of the crannog dwellers.

It is not only the way of life of people who lived on artificial islands which will be clearer. The house on the platform is in essence the same as a round timber house in a hillfort or on an unenclosed platform on a hillside. In many cases the function would be similar. Whether a dwelling is defended by surrounding water, or by strong walls as in the case of brochs and duns or is minimally defensive as in the case of many hut circles it is probable that most were essentially defended farmsteads. By extrapolation the way of life of a much greater part of the late prehistoric population of Britain may be realised by the results from crannogs.

Not only will the domestic life of a significant part of the community become clearer but the interrelationship of different groups in the community may be examined. For instance, in the broader context of the Loch Tay valley, where the number of crannogs which are contemporary may be shown by the dating of timbers, the excavation of a group of sites will allow the finds assemblages, structural elements and landscape exploitation to be compared and contrasted in a scientific manner. Evidence of the overall social and political organisation and the structure of the social hierarchy in prehistory is notoriously sparse and difficult of interpretation. It is possible that the well-preserved material from crannogs may help to make the task more feasible in the future. The remains of specialised

industries or activities related to the observed standard of living in different crannogs may help to explain the standing in the community of particular specialists. It should also be interesting to observe developments of society through the transition period between the Bronze and Iron Ages in terms of cultural change, if any.

Ultimately the relationship between groups of sites such as those in Loch Tay and Loch Awe may be examined in terms of two communities about which a great deal may be ascertainable through excavation. Whether there was trade, influence or contact the two may be established and it is not unreasonable to consider even wider contexts. The Loch Tay group had access by the River Tay to the east side of Scotland and to the Clyde estuary by the way of Glen Ogle to Loch Earn, down Loch Lubnaig, Loch Venachar and Loch Ard and eventually down Loch Lomond to Dumbarton. It is notable that in all of these lochs and in the Clyde estuary itself there are crannogs though they are not yet demonstrably contemporary with those in Loch Tay.

Chapter Thirteen

Conclusions

13.1 Introduction

In the beginning of this thesis the surveys and excavations which had been carried out on the subject of Scottish crannogs in the nineteenth and early twentieth centuries were outlined. The inferences made by the early researchers and the conclusions which they came to, as presented mainly by R. Munro, showed a general view of a type of structure constructed in a particular way. It has been shown that after the end of the nineteenth century no significant changes have taken place in the views accepted from Munro and that these views have continued to the present time.

It was pointed out that if crannogs are as well-preserved in terms of structural elements and organic debris as the early research indicated then they may offer a great deal of information about the history of Scotland from as early as the first millenium to as late as mediaeval or post-mediaeval times. The reason why past work on crannogs has, in fact, supplied very

little to the archaeological record in the long term, has been shown to be a result of the primitive standards of excavation of the early excavators and practical problems of the difficulty of excavating drained or partly-drained sites.

The development of excavation methods and techniques has overcome the first problem to a great extent and the second, it is shown by the main body of this work, can be overcome by excavating crannogs underwater using techniques developed over the last twenty-five years and applying to them the rigorous standards of observation and recording of modern archaeological practise. The location, observation and representation of submerged crannogs is shown to have few problems in practical terms and although much of the work is still undergoing development, it is firmly enough established to be of great use and value. The surveys carried out in 1972 and 1979 in Loch Awe and Loch Tay have shown the potential in this area. It is no longer necessary to wait for lochs to be drained or to rely upon fortuitous sitings to build up distribution maps. The form of sites can be recorded as on land surveys and will allow more detailed correlation and interpretation as a group of monuments than was previously possible. They can be examined in detail and compared or contrasted to build up a more complete classification, so differences of type can become apparent. They can also be viewed in terms of other sites throughout the country for the first time. It is now very evident that crannogs are not restricted to the south-west of Scotland. They occur all over the country, often in unsuspected areas.

As recently as the nineteen-seventies doubt was expressed in the National Monuments record archive as to whether the Oakbank mound was in fact a crannog. So far only about 20% of the area of the site has been excavated and in a much smaller area has complete excavation been carried out to the loch bed. Yet even this small sample has, through the application of modern archaeological practise and thought, indicated answers to some of the questions posed in the nineteenth century.

13.2 Conclusions

It was not the primary aim of this work to answer questions posed by the results of earlier researchers. The fact that the excavation has already shown where some answers may lie, particularly in the area of structure and the reasons for submergence, is a bonus and emphasises the value of this kind of work. This thesis is not an excavation report. It was not intended to be and indeed could not be since only a small part of the Oakbank crannog has so far been excavated.

The aim of the project was to demonstrate the potential of excavating crannogs underwater in three areas which may be considered under the headings of feasibility, viability and value. Feasibility is the actual ability to carry out work underwater to standards of accuracy and efficiency at least equal

to those demanded of comparable work on land. Viability is the cost-effectiveness of the operation since even if it were feasible to carry out the work it would not be viable if the cost was above budgets which may reasonably be met in normal archaeological terms. And value is the archaeological value which may be derived from the work not just in terms of knowledge accruing to the subject of crannogs but to the archaeological record as a whole.

13.2.1 Feasibility.

Before the excavation began there was little doubt that effective work could be carried out on archaeological sites underwater since similar work had taken place in Switzerland for a number of years. However, it was not known whether the material make-up of a crannog would be compact enough to allow observation, excavation and recording of a high standard. Removing boulder layers posed no problems and the organic matrix was shown to be firm enough for effective handling. There is no reason to doubt that the same will apply to other similar sites according to the reports of earlier excavations and the observations of organic debris on other crannogs in Loch Tay.

A major area of uncertainty was the difficulty of recording accurately the site as a whole and the elements of the site during excavation. The first of these problems can be overcome using a variety of methods ranging from aerial photography to computer graphics but the most effective, in terms of speed, accuracy and cost, is the tape and staff survey by people in the water. For greater accuracy an electronic distance measuring instrument can be utilised and such a machine was used effectively for surveying the mound, jetty and causeway piles at Oakbank.

For planning elements in the area undergoing excavation normal methods of tape off-setting or triangulation and feature drawing are carried out as on a land site using the usual readily-available tools such as tapes and rulers, while drawing on drafting film. The problems of parallax distortion and accurate drawing by cold workers was overcome using methods devised by Dr. Ruoff in Switzerland and the resulting plans are as accurate as those from any land site. Overall no serious drawbacks to accurate and efficient drawing and planning were encountered at Oakbank.

The control and supervision of a team of archaeologists split between shore and underwater work was expected to be a problem but in fact this did not prove to be the case for two reasons. Firstly, the whole team was restricted in size to no more than twelve people, and often less, since three or four

workers in the water at a time is the most that can effectively be catered for. Secondly, the two groups must necessarily work in close conjunction since the shore team is effectively an extension of those underwater. This close contact means that each group is intimately involved with the work of the other and less supervision is required.

The ability to combat the cold of the loch water and enable the excavators to stay down long enough to maintain continuity of tasks was possible with the use of standard sports diving equipment. More professional or even heated suits would make the work more comfortable but the fact that the excavations to date have not used such equipment emphasises that expensive specialist gear is not essential. Most items of personal equipment, including suits, are very much a matter of individual preference and most archaeologists working underwater look to their own needs even when communal gear is supplied.

The machinery for working underwater, particularly compressors, air cylinders and the like, have often been developed for tasks much harder than those they are required to fulfil at Oakbank crannog. They are readily available and the shallowness of the site usually means that the simplest, and least expensive, models suffice. For instance a surface demand compressor rated for two divers to 25 metres depth will easily supply four in 4 metres. Excavation equipment, such as water dredges and current machines, have also been tried and tested in harder conditions than those at Loch Tay and the modifications

and adaptations which may be required are no more than would be expected to comply with the particular situation on any site.

Only two problems were encountered at Oakbank which could not quickly and simply be overcome. The first was the tendency for divers to develop ear infections which were both painful and inconvenient. The latter because part of the remedy requires the sufferer to stop diving. It appears that this problem has been almost overcome since it affected divers in a rundown condition and prevention is simply to keep them well-fed and ensure that they get adequate sleep.

The other problem is less easily remedied. It is the short choppy waves created by the wind blowing up the loch, usually from the south-west. They make it difficult to work from a boat or to stand on the boulders of the site and conditions underwater become very uncomfortable. The constant rhythmic movement has produced sea-sickness in the past and delicate tasks, including site drawing and excavating fragile objects, are very difficult.

The only answers so far are to carry out work on deeper parts of the site where the water movement is less or to leave the water. These are not satisfactory alternatives since the wind, being the prevailing wind, can continue for many days particularly near the equinoxes. One way of minimising the problem is to excavate in summer or winter but winter storms and the cold make the latter inadvisable and even in summer there is the risk of wind. It is planned in the future to make

experiments with various devices such as rafts with chains or heavy nets hanging down from them to break the force of the waves but these efforts may prove more trouble than they are worth.

The practical task of excavating crannogs underwater with a level of accuracy comparable to recording on land has been established over the three seasons of work at Oakbank. Though development in method and techniques are continuing the feasibility of the work has been demonstrated.

13.2.2 Viability.

The prospect of success in continuing systematic research on the subject of crannogs by excavating them underwater is directly related to the cost-effectiveness of the project. If the cost is significantly higher than land excavation then it is unlikely to attract financial assistance from institutions with an interest in archaeological fieldwork.

The work at Oakbank was carried out in three seasons adding up to fifteen weeks in all. Added to this were a number of two to five day periods during which further work, usually specific tasks, was undertaken. The cost, in grants from various bodies, came to just over £3,000, the greater part of which was paid out for accommodation in rented houses. Comfortable living quarters were judged necessary for the health of the divers after tents

proved unsatisfactory in the first season.

The figure of £3,000 does not include a number of costs which would relate to most other excavations nor does it include the cost of machinery. None of the workers at Oakbank were paid travel expenses, subsistence or fees and those involved in the underwater work supplied their own suits and basic diving equipment. Underwater archaeology is a growing discipline and at present a number of divers are willing to invest some of their own resources to gain experience. Full advantage should be taken of this situation while it lasts. However, it is seldom possible to recruit the services of personnel on an unpaid basis for the full period of the excavation and consequently full training and familiarity with the site are lost. It would be an advantage if at least one or two archaeologists were paid to stay for the full period.

The cost of major machinery has not yet been borne by the Oakbank excavation since available equipment was supplied by the Institute of Maritime Archaeology at St. Andrews University. This is the main area where underwater excavation can prove more expensive than on land but on many land excavations the cost of hiring dumper trucks, soil stripping machinery or scaffolding can add as much or more to the cost. The major pieces of equipment that would be required for underwater work and their life expectancy are listed below:

Surface demand compressor	1,500	10 years
High pressure compressor	1,500	10 years
Air cylinders -- 4	350	10 years
Demand valves -- 4	350	5 years
Inflatable boat	2,000	10 years
Outboard motor	500	5 years
Sundries (suits, weights, etc.)	1,000	5 years
Total	£7,200	

This list covers a number of expensive items which are not essential and which could be replaced with less expensive alternatives. For instance a well-made raft could replace the inflatable at minimum cost and the outboard motor could be omitted entirely since it cannot be used with divers in the water anyway. However, both of these items are so useful for associated work and safety that they would be advised. The fact that most of these pieces of major equipment will last for ten years means that the overall cost/season is not significantly different from work on land.

It is worth pointing out that once the boulders are cleared from the organic remains of a crannog the amount of well-preserved material is far greater than on a land site so that even if the overall cost is greater on an underwater excavation the cost per unit of information may be far less. This also means that a shorter period on an underwater site will

produce more useful data than a longer period on land, assuming that the data is there to be retrieved in the first place.

One cost which may be incurred in underwater excavation which is seldom encountered on a land site is for conservation. So far the material from Oakbank crannog has been taken to the conservation laboratory of the National Museum of Antiquities of Scotland in Edinburgh. However, only a small proportion of the material from the site has been treated due to shortage of manpower and funds. None of the wood-chips are being treated and even a number of clearly cut timbers are too much for the facility. Regular inputs of wet wood would quickly saturate the system which is already almost full.

An alternative is to set up a separate conservation facility dealing only with the wood from Oakbank and other crannogs. Such a system is already operated by the Somerset Levels Project with apparently satisfactory results (Coles and Orme 1977, 87-89; 1981, 70-78). The cost of polyethelene glycol, the most popular chemical for treatment, would be considerable but if the material is to be preserved for display or future research the cost will have to be borne. Another alternative is to keep the material wet with interesting pieces in transparent containers so that they may be displayed. If the containers were airtight no maintenance should be necessary and the objects would not acquire the greasy appearance which inevitably results from the conservation technique. In Switzerland only the finest pieces are conserved and the great mass of material is destroyed after

recording. The problem of conservation is becoming serious as more wet sites are being tackled and the situation at Oakbank requires more consideration than it has so far been given before a satisfactory solution, or a compromise, can be reached.

Within the terms of reference of this thesis it has been shown that excavating crannogs underwater is a financially viable exercise comparing well with the cost of land excavation. Final conservation does not strictly fall within these terms but has to be considered as a direct result of the work.

13.2.3 Archaeological Value and Potential.

It is only possible to quantify the archaeological value of any type of site by relating it to other sites and their contribution to the archaeological record. In these terms crannogs have a great deal to offer as has been shown by the information already derived from the relatively small area excavated at Oakbank. That small area included part of a round house with a surrounding walkway, the interior floor, the entrance to the building and elements of features which have not yet been explained. Possibly the most important aspect of these remains is that they are three-dimensional with piles and stakes standing to over 1m high in this area, and presumably over 2m high in deeper parts of the site, and with a deep deposit of organic material containing two living floors and the debris

which built up on them during the lives of the site's inhabitants. Within the organic deposit in the form of pollen, seeds, animal remains and artefacts is a record of how these people lived.

If the site at Oakbank had been on dry land the remains likely to have survived would probably have consisted only of a sub-circular spread of boulders with a few post-holes in the sub-soil. The stone, clay and flint artefacts would offer little insight into the background and history of the building and its inhabitants. It is the contention of this thesis that draining a submerged crannog is the first stage in the process of degradation which results in the land situation and it is shown by the above results that the process begins, with considerable effect, within minutes of exposure. To maintain as high a degree of preservation as possible the most effective method of excavation is to work underwater. It has been the aim of this thesis to demonstrate that the excavation of crannogs underwater is feasible, viable and of value to archaeology.

Abbreviations.

BAR. British Archaeological Reports.

CAGAA. Historical and Archaeological Collections of the Ayr and Wigtownshire/Galloway Archaeological Association.

DES. Discovery and Excavation in Scotland.

IJNA. International Journal of Nautical Archaeology and Underwater Exploration.

ISS. Invernessshire Scientific Society.

Jut. Arch. Socy. Pubs.. Jutland Archaeological Society Publications.

PBUSS. Proceedings of the Bristol University Speliological Society.

PPS. Proceedings of the Prehistoric Society.

PRIA. Proceedings of the Royal Irish Academy.

PSAS. Proceedings of the Society of Antiquaries of Scotland.

PSANHS. Proceedings of the Somersetshire Archaeological and Natural History Society.

Sci. Am. Scientific American.

TGAS. Transactions of Glasgow Archaeological Society.

UJA. Ulster Journal of Archaeology.

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Appendix A.

The major part of Appendix A is a reprint of a paper published in the Proceedings of the Society of Antiquaries of Scotland (Dixon 1982) which is the results of a survey of Loch Tay in 1979. Some of the points and illustrations may be slightly different to those of the main thesis. The body of the thesis takes precedence over any reiterated remarks in the appendix which includes the full paper only for the sake of completeness. Following the Loch Tay survey results are a map and plan of Loch Awe showing the distribution of crannogs there and an outline plan of nineteen of the sites (after McArdle).

Proc Soc Antiq Scot, 112 (1982), 17–38

A survey of crannogs in Loch Tay

T N Dixon*

INTRODUCTION

In May 1979 a survey of the crannogs in Loch Tay was carried out by a team including members of the Dept of Archaeology and the Sub-aqua Club of the University of Edinburgh. The aim of the survey was to locate and plan the artificial islands in the loch, to examine them for evidence of typical crannog features and to assess the potential of the sites for useful environmental and dendrochronological sampling and eventual excavation. Results of the survey were very satisfactory and a preliminary excavation was carried out on a crannog off Fearnan village on the N side of the loch during August and September 1980 (Dixon 1981).

Loch Tay was chosen because it is one of the larger Scottish lochs, with good access, but mainly because Mr Colin Cruickshank of the Physical Education Dept, Edinburgh University, had marked on a 1 in OS map all the obstructions into which he had sailed during sail training with students on the loch. He recognized the obstructions as crannogs after personal examination underwater and reference to a useful local history. *In Famed Breadalbane* (Gillies 1938) records a local tradition that 24 islands were built in the loch at the expense of Alexander I of Scotland, and goes on to locate accurately 12 of the crannogs and one possibly demolished example.

The loch is 24 km long with a maximum breadth of just 1·6 km. The deepest part of the loch is 155 m, about 10 km from the Kenmore (NE) end. It is skirted on both sides by mountains which on the N side rise to the height of Ben Lawers at 1214 m. The SW end is also dominated by mountains, but the NE end is open to Taymouth Park and the valley of the River Tay.

GENERAL REMARKS

Crannogs (fig 1) are artificial islands found abundantly in Scottish and Irish lochs, and occasionally in estuaries. Although there are many references to Welsh and English crannogs these appear to be closer to lakeside sites such as those in the Swiss lakes and none, so far, point to the same type of structure as the Scottish and Irish examples.

Other islands of an artificial nature may be found in Scotland, mainly in the form of duns, but there are differences in structure. Many of the crannogs examined have evidence for a strong internal timber framework, but there are about 350 documentary references to crannogs, so proportionately few have been looked at, and a timber framework may not necessarily be a prerequisite of classification as a crannog. Certainly bedrock is to be seen as part of the foundation structure in more than one case, although this does not preclude the use of timber in the structure. A definition of crannogs cannot at present be too firmly formulated owing to the lack of information available regarding visible structural elements.

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Classification of crannogs into different groups by style, region or period is equally ineffective at the moment for the same reason. The SW of Scotland used to be considered the main area of crannog concentration in Scotland, but this came about mainly because of the study and excavation carried out by archaeologists, especially Robert Munro, in the last half of the 19th century. A survey of Loch Awe carried out in 1973, the Loch Tay survey described here, and study of the documentary evidence, show a crannog distribution in the Highland zone comparable with the highest concentrations in the SW.

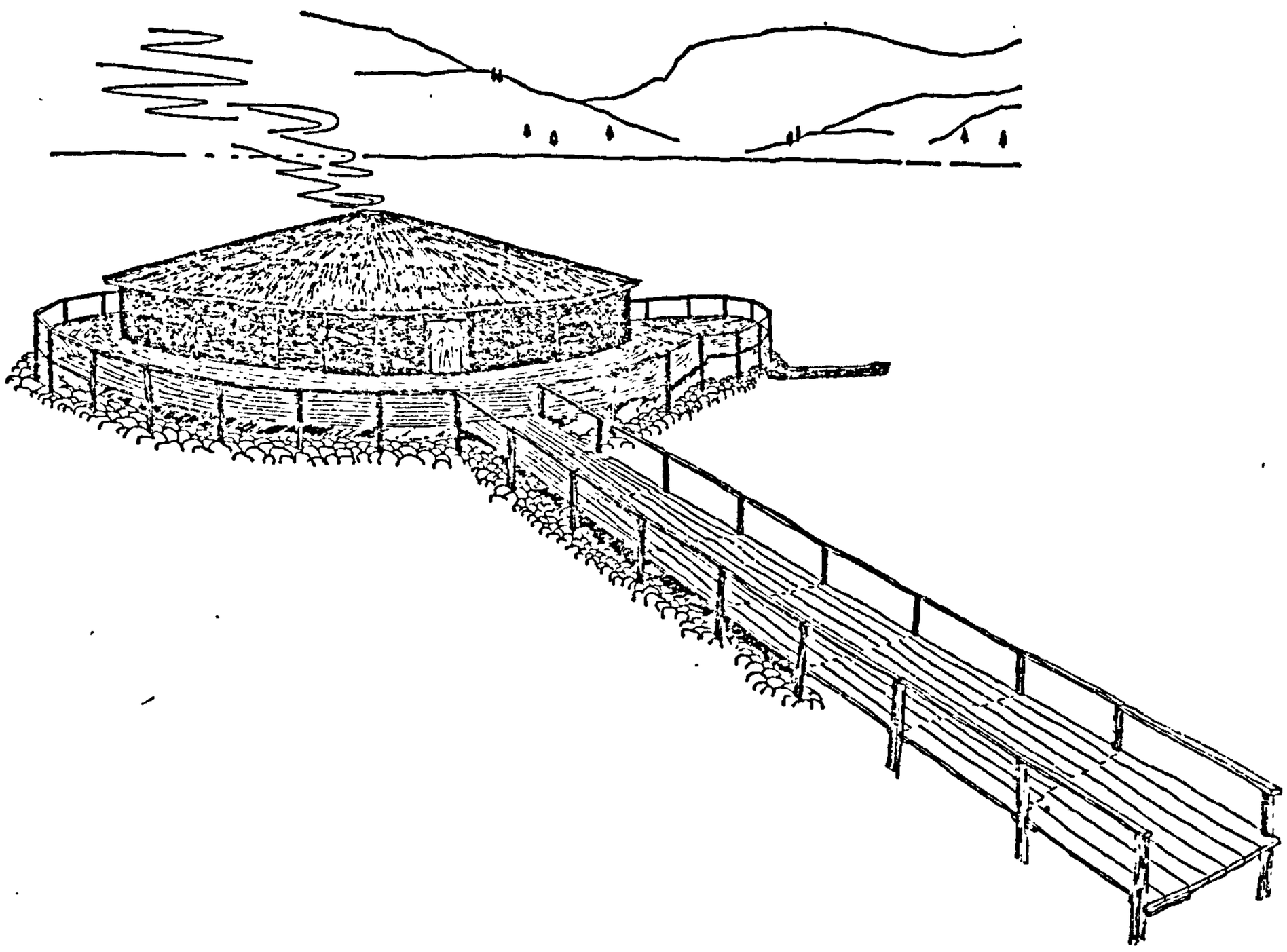


FIG 1 Conjectural reconstruction of a crannog, based on Fearnan (no 3)

Crannogs are remarkable for the length of time over which they were used, whether as temporary or permanent habitation sites. So far in Scotland the earliest dates are for Fearnan Crannog (no 3 in gazetteer) with C14 dates of 595 bc ± 55 (GU-1323) and 460 bc ± 60 (GU-1325), and the site off Fearnan Hotel (no 4 in gazetteer) at 525 bc ± 55 (GU-1322). These compare well with Milton Loch Crannog, which produced a plough stilt dated to 400 bc ± 100 (K-1394) and a structural timber dated to 490 bc ± 100 (K-2027). The major part of the evidence from this site suggested to the excavator an earliest occupation during the 2nd century AD, but the crannog was not totally excavated as the lower layers were always under water. Other crannogs date from the time of the Roman occupation, the Dark Ages and throughout the Medieval period. Whether initial construction took place during these times is not known.

Crannogs have been studied by a number of people in the past, often stimulated by the draining of lochs for agricultural land. The first proper assessment was a paper by John Stuart presented to the Society of Antiquaries of Scotland in 1865 dealing with crannogs in the SW and elsewhere (Stuart 1865). However, the major studies were carried out by Robert Munro, with various excavations, primarily of Lochlee, Lochspouts and Buston crannogs in Ayrshire, leading to the publication of *Ancient Scottish Lake Dwellings* in 1882 and *The Lake Dwellings of Europe* in 1890. Although his standards of excavation would not be permissible in modern archaeology, his observations of the basic features of crannogs have been shown to be fundamentally accurate by later excavations.

In the first 15 years of the 20th century an Augustinian monk, the Rev Francis Odo Blundell, examined various crannogs by the use of a diving suit loaned to him by the Clyde Navigation Trust. His work stimulated the British Association for the Advancement of Science to form a committee which sent circulars to all regions in Scotland asking for information relating to crannogs. Blundell investigated many of the replies to the circular, publishing his findings just before the First World War (Blundell 1909, 1910, 1913). For two seasons starting in 1914 a crannog in Loch Kinellan was examined by Hugh Fraser. A number of trenches and pits were opened but work was impeded by water seeping into the excavations. Pottery from the site indicated occupation in about the 15th century AD (Fraser 1917).

Since the work of Blundell no systematic fieldwork has been carried out on crannogs. The few excavations which have taken place have been caused by the draining or lowering of lochs for hydro-electric power schemes. These are Loch Treig, excavated in 1933 (Ritchie 1942); Loch Garry, excavated in the early forties but not reported due to the death of the excavator, Professor Ritchie; Milton Loch, excavated in 1953 (Piggott 1953); Loch Glashan, excavated in 1960 by Mr J Scott and not yet fully reported.

An Edinburgh Univesity MA dissertation, entitled *Aspects of Crannogs of the Solway-Clyde Province* is a useful guide to that area (Savory 1973). A more complete piece of work, by G. Oakley for an MLitt degree from the University of Durham, is to be recommended for its coverage of the material throughout Scotland (Oakley 1973). Research is also in progress by Mrs F Murray of Falkirk Museum on the finds from crannogs.

In 1973 a survey of the crannogs in Loch Awe was carried out by a team of Naval Air Command divers in conjunction with Drs T McArdle and I Morrison of Edinburgh University. Five possible crannogs were previously recorded in the loch but this survey recognized 20 definite examples. Features of these crannogs included middens, harbours, jetties and causeways; evidence of stone and timber construction was also noted.

The chief bone of contention as to the true function of crannogs has been whether occupation was temporary or permanent. Regrettably, no excavation to date has been able to establish through stratification the length of habitation prior to abandonment, but evidence from the Loch Tay excavation is indicating the likelihood of reasonably long periods of occupancy. From this crannog, no 3 in the gazetteer, have come very high concentrations of cereal pollen and weeds of cultivation, and deposits of animal droppings (probably sheep) in a deep layer of bracken and moss which has every indication of having been the bedding material in a byre. Continuing work should give some clues to the length of time this floor was in use.

Metalworking was practised on some sites. Iron slag was found at Buston, Ayrshire (Munro 1882), and from the Loch of Dowalton; Buston also produced a crucible with globules of gold adhering to the inside. Whether these processes were a significant feature of the inhabitants' activities cannot yet be deduced.

GAZETTEER

Seventeen definite crannogs were located in the loch and planned (fig 2). Of these, five are islands with the tops exposed above water level at all time and with established vegetation. Five are just exposed when the loch is at its lowest in summer, although in three cases this may only be

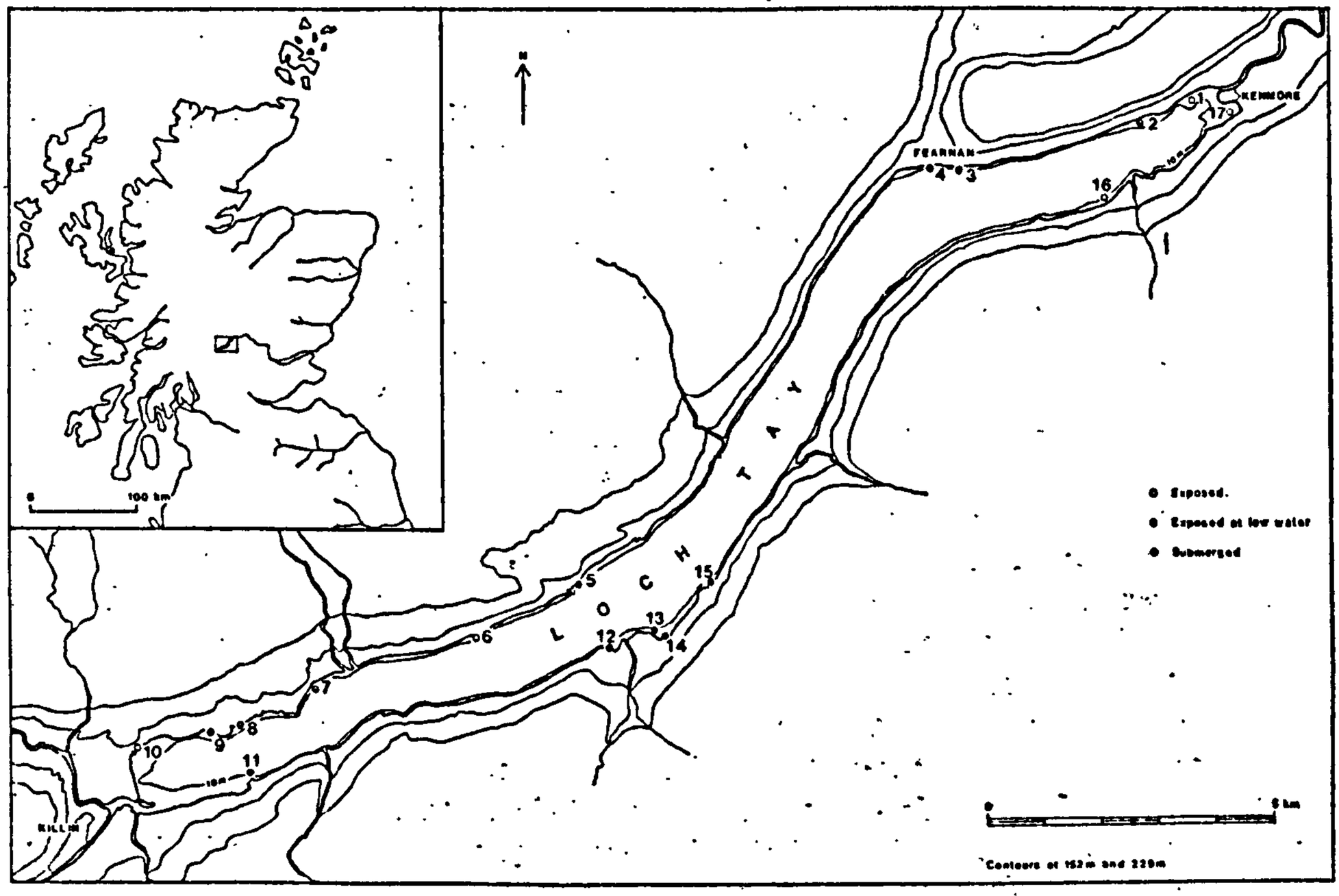


FIG 2 Location of crannogs in Loch Tay

because the top of the crannog was built-up in fairly modern times to support beacons for warning-off boats. The remaining seven are all well submerged and unlikely to be exposed at any normal level of the loch.

The names assigned to islands in the gazetteer are those used by the Ordnance Survey in their latest records. Submerged sites or those with no known names are normally called after the nearest habitation. Popular names or those used in the past are included, but the modern nomenclature is in italics. The numbers before the name accord with those on the location map and plans and will be used when referring to specific sites in the text. Dates are those when the actual survey was carried out.

1. *Priory Island*, Isle of Loch Tay, Eilean Nam Ban (Island of the Women). NN 766454
Not planned

This is the largest of the islands in Loch Tay and is at least superficially of artificial construction. It is c 70 m by 50 m and oval in shape. The loch to the N and NW is very shallow, 1·5 to 2 m, but slopes down to the SE so that on this side the depth ranges from 3 to 4 m. There appears to be considerable silting at this

end of the loch and the island probably once stood higher above the loch bed than at present. The crannog is constructed of medium to large boulders weighing up to 50 kg.

The island is first noted in a charter signed at Stirling by Alexander I granting it to the monks of Scone Abbey which he had recently founded. This grant was reputedly as a result of the death of Alexander's consort, Queen Sybilla, who became ill and died on the island on 12 June 1122 and was subsequently buried there (Gillies 1938, 118). Later, the island was the fortified home of the Campbells of Glenorchy and ruins of a building, probably erected by Duncan the 2nd Earl of Glenorchy after a destructive fire on Palm Sunday 1509 (*ibid* 35), still stand to a substantial height. No evidence is available for the date of construction of the island but a reference (*ibid* 35) to a Ewan MacDougall of the district has the statement by him 'this island, with 23 more of lesser size was built in the loch at the expense of King Alexander the First of Scotland'. This seems questionable, as the known islands and underwater mounds

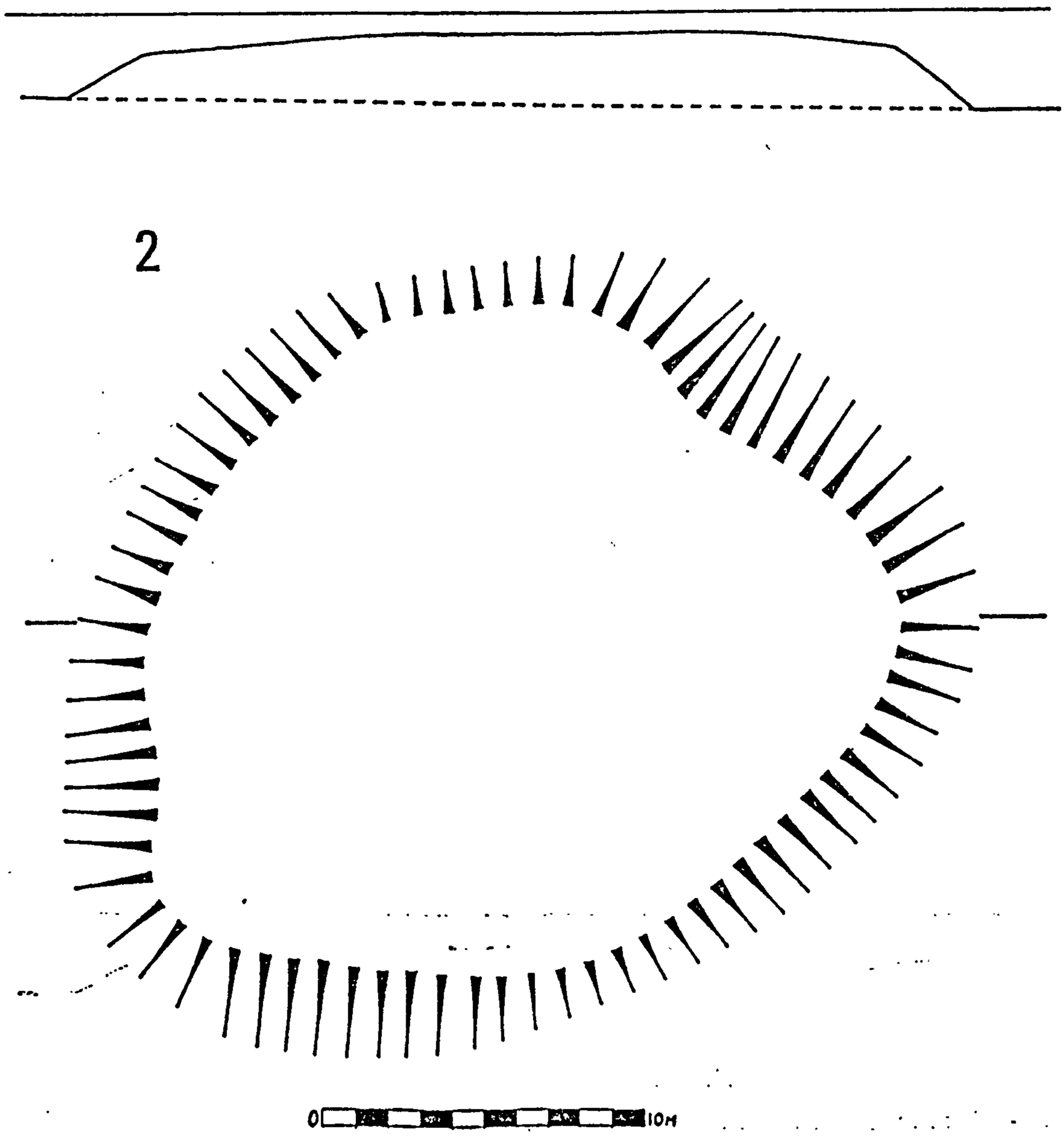


FIG 3 St Mary's Distaff: plan and section

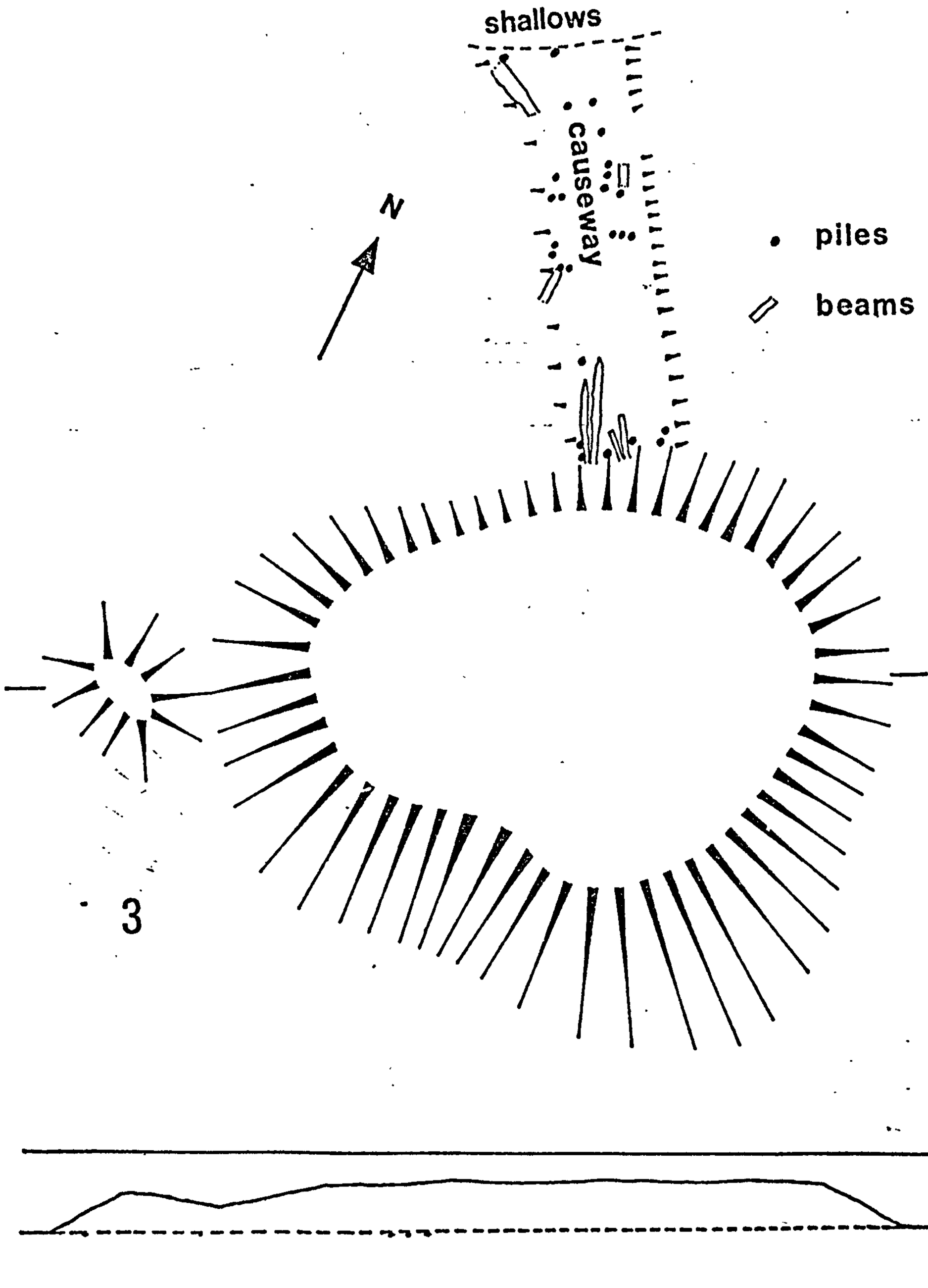


FIG 4 Fearnan: plan and section

in Loch Tay do not have common styles, levels or materials of construction. No structural timbers have yet been noted which would enable dendrochronological or radiocarbon dating of Priory Island.

The size of the island and extensive tree cover made planning impractical during this survey. It has been drawn at 1:10 000 by the OS and the building on the island, referred to as a manorhouse by them, is planned at 50 in to the mile (OS Archaeology Division card no NN 74 NE5). The island is also marked on Blaeu's Atlas of 1769 and is probably one of three settlements indicated in the loch on Mercator's map of 1620.

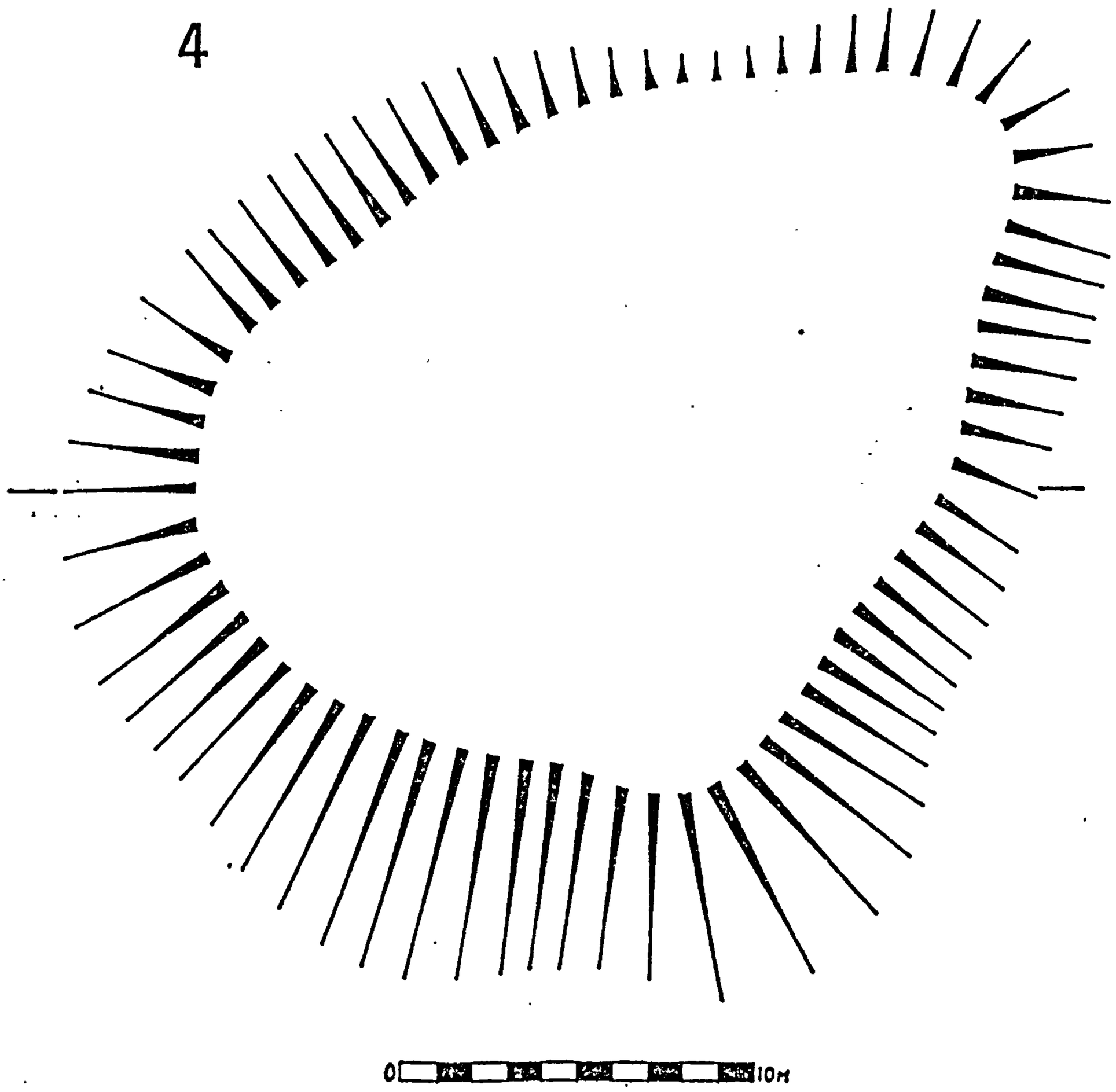


FIG 5 Fearnan Hotel: plan and section

2. *Mary's Distaff* (fig 3). NN 757450
26 May 1979

This crannog lies about 50 m from the shore near the old steamer slipway at Delarb, Kenmore. It is marked by a pole with a metal fish at the top; an earlier metal girder marker is still lying on top of the mound. The depth of water round the structure varies from 1·8 m to 3·3 m, when the highest point is 0·65 m below the surface. These measurements were taken in the month of May. When photographed from the air three months later the top of the crannog was exposed above the surface.

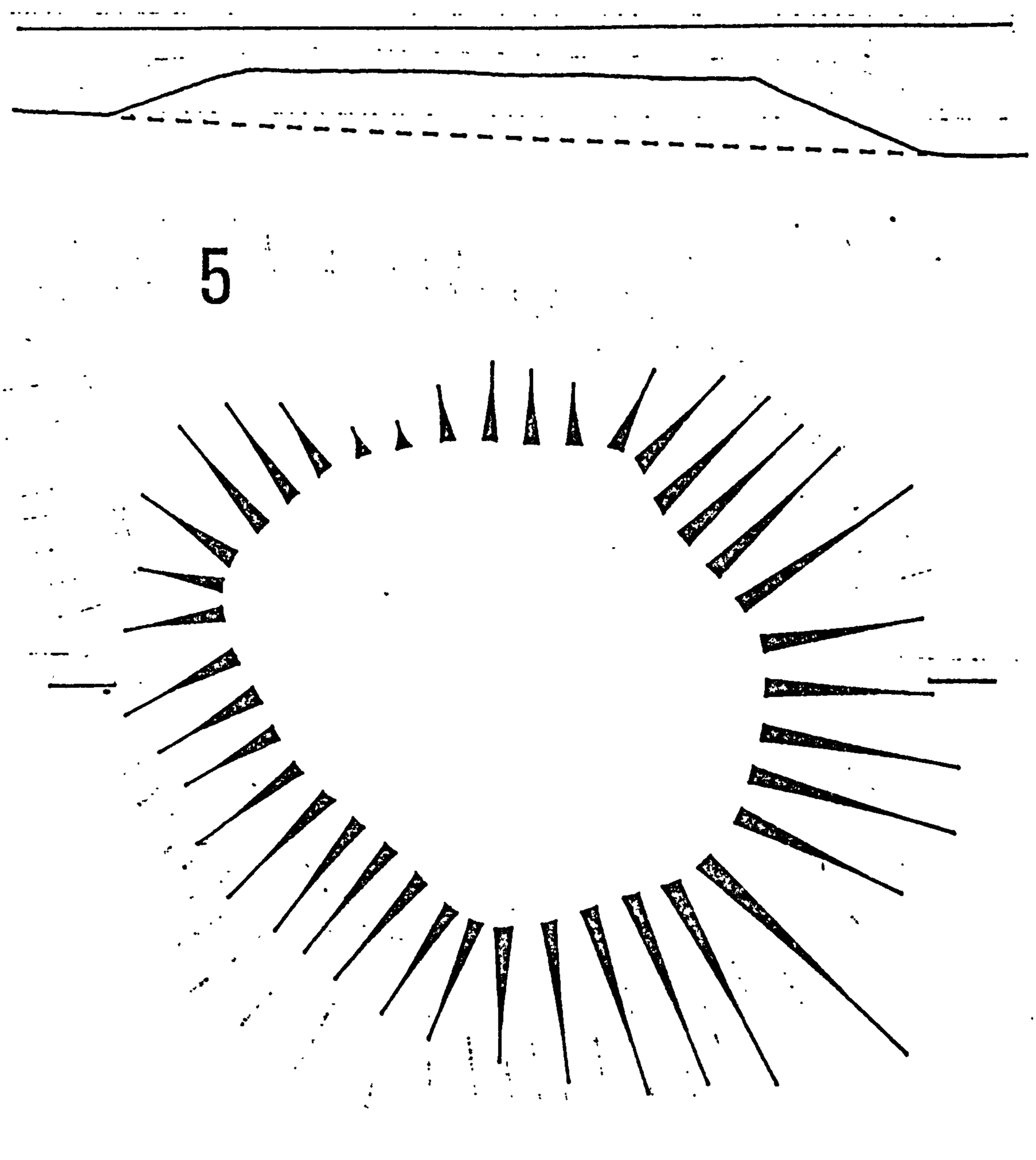


FIG 6 Tombreck: plan and section

There was no obvious evidence of structural timbers but some of the boulders of which the crannog is at least partly composed are very large and in some cases appear to have been building material. The mound is roughly circular with a diameter of 24 m at the narrowest part and 30 m at the widest. The sides of the mound slope fairly steeply, c 1 in 2 (50%), and the top slopes slightly from a depth of 0·65 m to the top edge which varies from 0·7 to 1·7 m.

3. *Fearnan Crannog* (figs 1, 4). NN 726442
5 June 1979

This crannog lies c 30 m offshore. When examined the highest point of the site was just over 1 m deep, sloping slightly to 1·25 to 1·5 m at the edge of the flat top. The bottom of the crannog was just over 2 m deep on the shore side and sloped down to just over 3·6 m on the SE side furthest from the shore. Just off

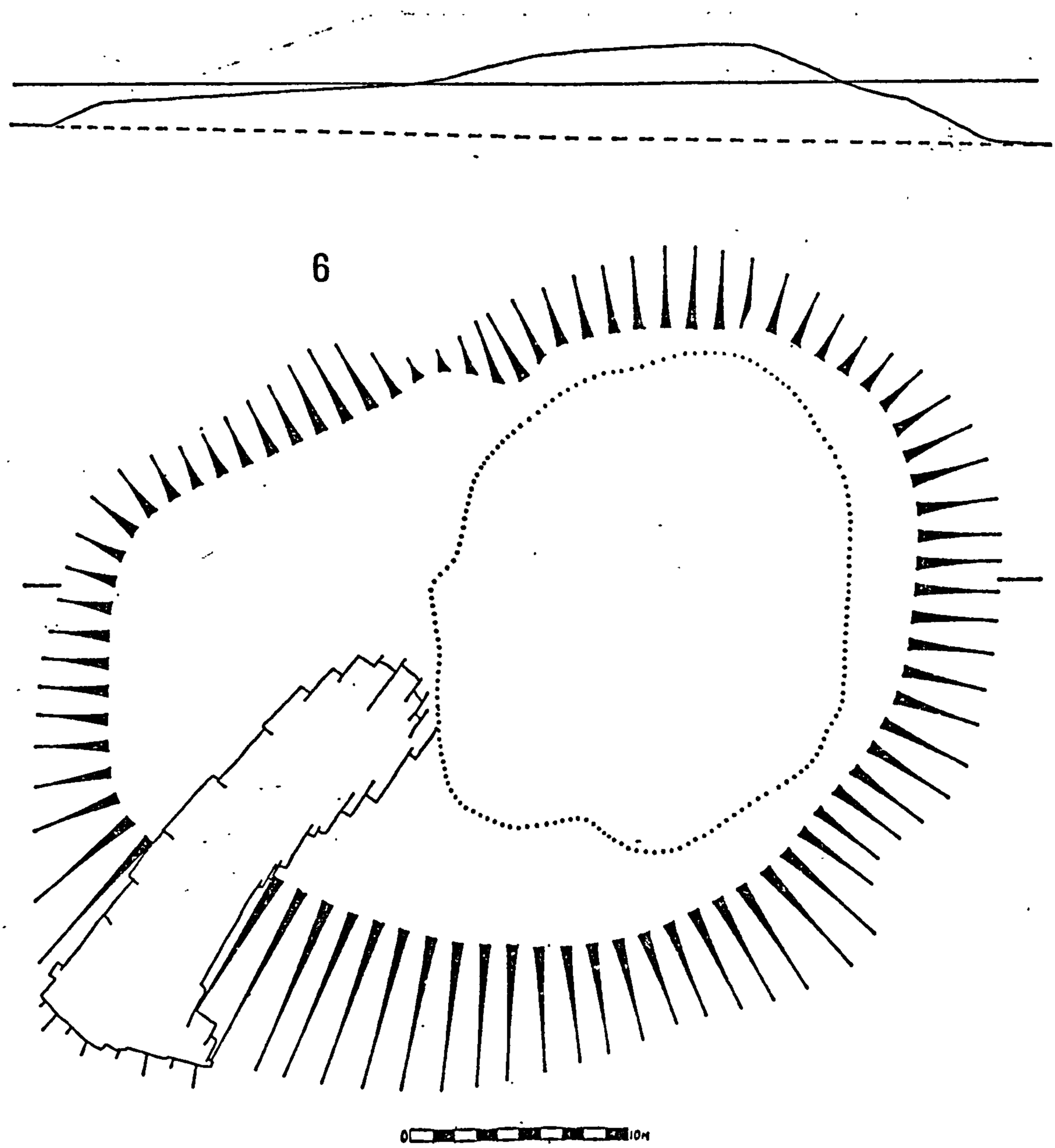


FIG 7 Eilean nam Breaban: plan and section

the main crannog on the SW is a smaller circular feature which is now, if not in earlier times, joined to the main mound by a small neck of boulders. This smaller feature is c 7 m in diameter. The stones joining the two structures may be accumulated spill from each of them. In the angle to the S where the two mounds meet are the remains of at least four softwood piles and one of oak, and also what appear to be two or three softwood planks. The oak pile was sampled with a view to dendrochronological dating but had too few rings to be of use. A radiocarbon date of 460 bc ± 60 (GU-1325) was obtained. The softwood piles had been abraded until level with the sand and gravel of the loch bed. On the N side of the main crannog are two rows of oak piles running between the crannog and the shore. These piles must at one time have carried a causeway for access to the crannog. Another oak pile on the top of the crannog was sampled. It also

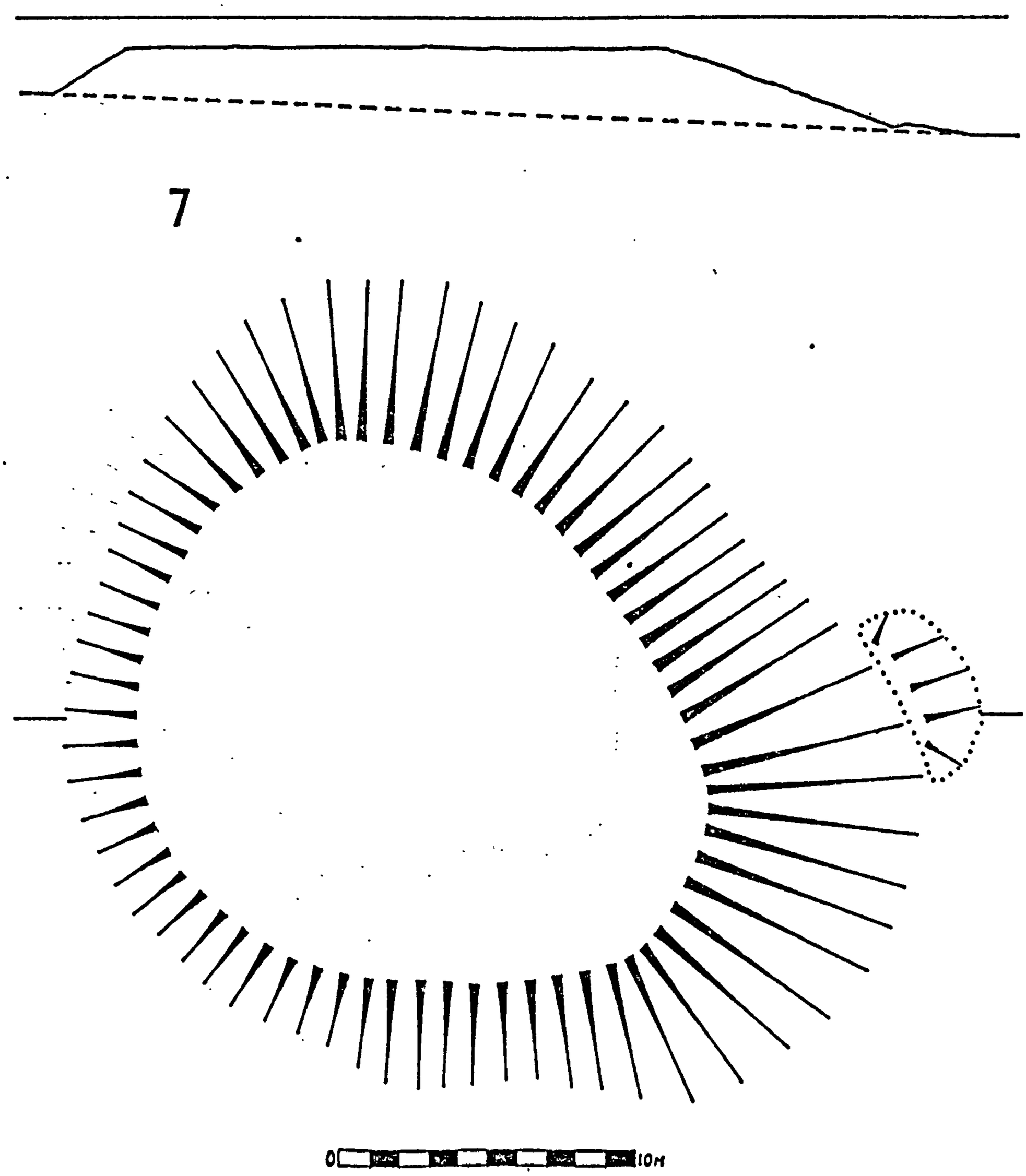


FIG 8 Milton Morenish: plan and section

proved to have too few rings for ring dating but gave a radiocarbon date of 595 bc ± 55 (GU-1323) making this crannog the earliest dated example in Scotland. Subsequent excavation has proved substantial remains of the occupation layers with excellent preservation of organic material (interim report: Dixon 1981).

4. *Fearnan Hotel Crannog* (fig 5). NN 721443
26 May 1979

The crannog is just off the pier at Fearnan Hotel c 50 m from the shore and not far from the previous example, no 3. The roughly circular mound is 33 m in diameter at the widest and 28 m at the narrowest with the highest point 0·89 m below the surface. The highest point appears to have been built up, probably to hold a marker post, and the main part of the top area lies 1·11 m below the water, sloping down to 2 m at the shallowest point on the loch bed towards the shore, while the deepest point is 4·5 m at the bottom edge furthest from the shore.

Timber piles can be seen on the top of the mound. One of these was sampled and gave a radiocarbon date of 525 bc ± 55 (GU-1322). An oak plank was also sampled although it was from near the crannog base and not directly on the mound. A beam with a mortice slot was recorded some 10 to 15 m from the crannog and may well be related to it.

5. *Tombreck Crannog* (fig 6). NN 659371
10 June 1079

This crannog lies 30 m offshore to the E of the outlet of the Allt an Tuim Bhric burn below Tombreck Farm. It is smaller in diameter than most of the other Loch Tay crannogs, 22 m along the greatest axis and 16 m along the shortest, but has just as much depth of material. The highest point is 0·89 m below the water surface and the bottom edge is from 1·68 to 3·81 m deep. Within 1 m of the deepest

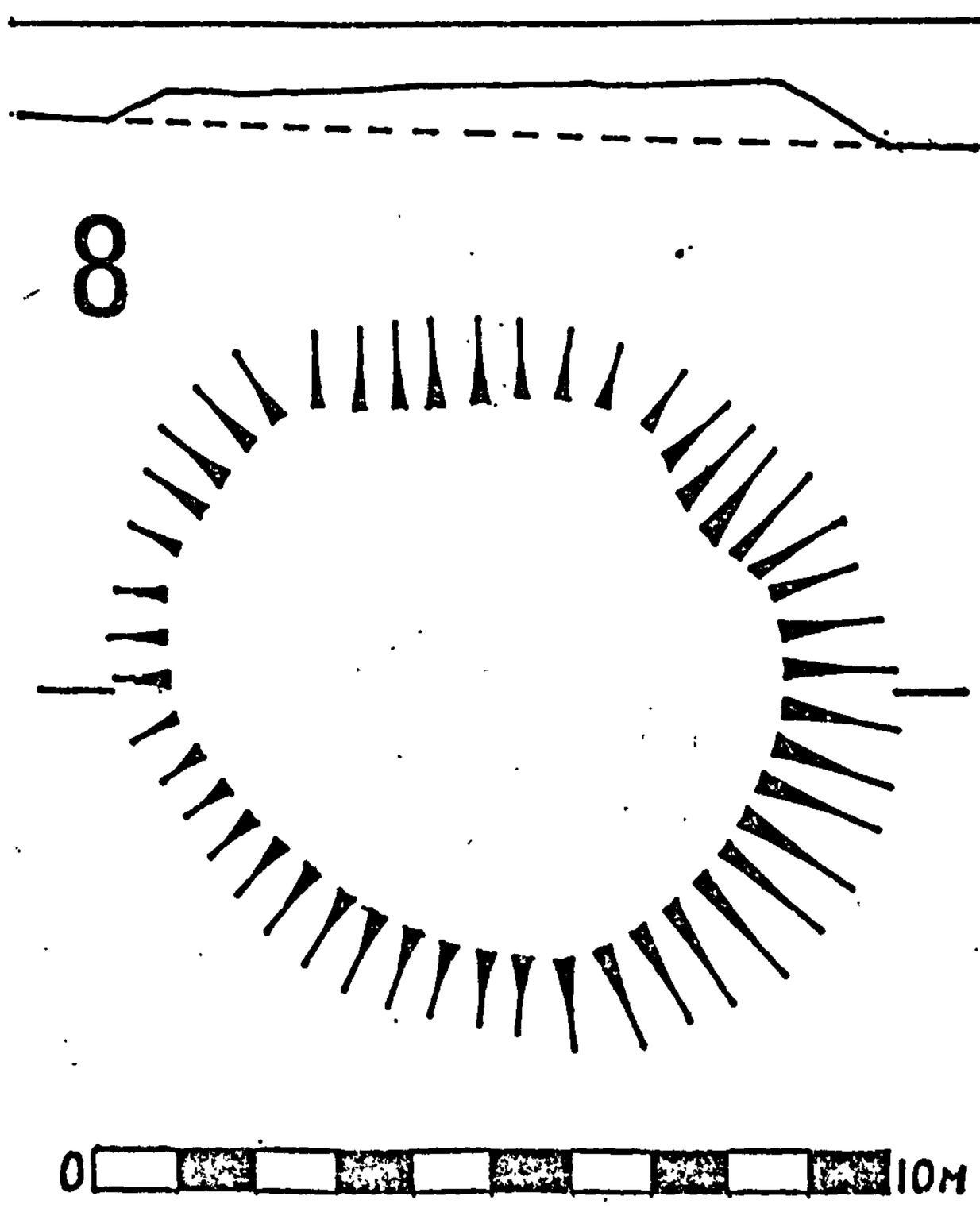


Fig 9 Milton Boathouse: plan and section

edge of the crannog can be seen three substantial worked timbers, two of which may be vertical piles. Many of the stones of which the mound is superficially composed are massive and may be the remains of buildings.

6. *Eilean nam Breaban* (Island of the Boot Soles), Ellan a Drippan, Ilane Brebane, Isla Brebane (fig 7; pl 1a). NN 641362
5 June 1979

This island, which is near the N bank of the loch, is exposed all year round, and in May to a height of c 2 m. It is artificial but an outcrop of natural rock, which can be seen underwater on the W side (pl 1a), has provided a solid foundation. The island is c 50 m in diameter with c 3 m of water on the S side and c 1 m on the shore side. The actual shape of the crannog is, as Croftmartaig Crannog (no 16), substantially

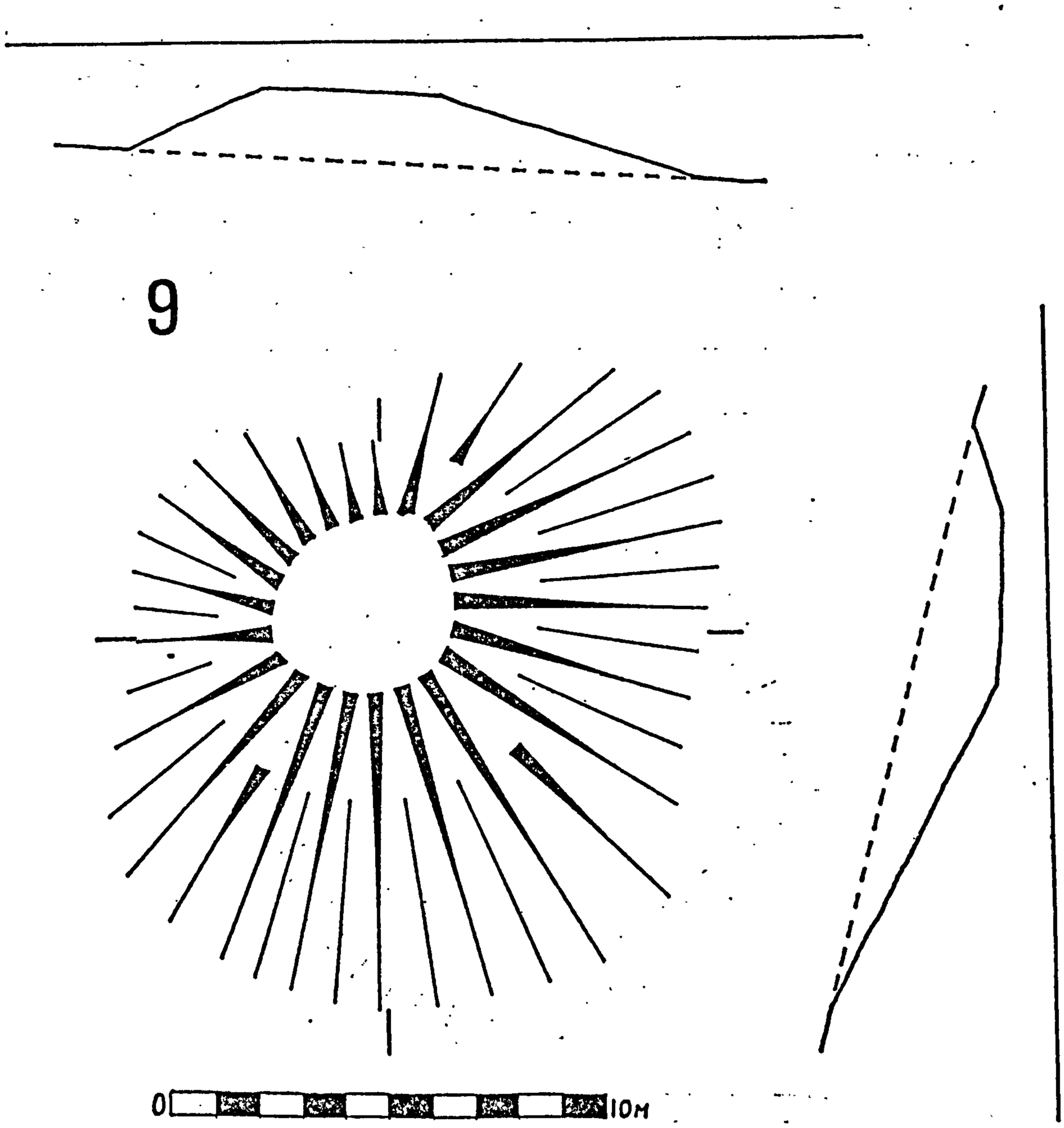


FIG 10 Morenish: plan and section

different from the structure seen above water. The mound extends to the SW beneath the surface for c 20 m, giving a roughly circular shape to the whole crannog. No timbers were noted associated with the crannog. Gillies (1938, 38) refers to a charter of 1526 transferring superiority of the lands of Carwhin from Haldane of Gleneagles to James Campbell of Lawers. The island is here referred to as Ila Brebane. He refers to another charter of 1546 in which it is called Ilane Brebane. In Blaeu's Atlas of 1769 it is shown as Ellan a Brippan and in Mercator's map of 1620 this island is the most likely candidate for the central of the three sites marked in Loch Tay. On the W side of the island a stone alignment may be the remains of a wall possibly dating to this period.

7. *Milton Morenish Crannog* (fig 8; pl 1b). NN 613353
25 May 1979

This crannog lies c 50 m off the N shore, and the top is just exposed when the water level is low (pl 1b). It is slightly oval, measuring 30 m across the greatest axis and 24 m across the shortest. The bottom edge is from 2·42 to 4·55 m deep. A small area of stones 6 m by 3 m extends from the E edge of the base of the crannog but this may be slip from the steeply sloping side of the mound. Just to the N of the bottom edge of this extension is a large oak beam with a mortice hole cut in it.

8. *Milton Boathouse Crannog* (fig 9). NN 600347
31 May 1979

This is a stony mound only c 0·6 m high and lying c 25 m off the N shore of the loch. It is roughly circular with a diameter of c 10 m, making it the smallest crannog in the loch. The highest point is c 0·75 m below water level and the bottom edge is from 1·06 to 1·64 m deep. It is possible that this crannog has been silted-up to a great extent and more of the structure might be located by probing. In this depth of water and so close to the shore the crannog would offer little protection.

9. *Morenish Crannog* (fig 10). NN 595346
24 May 1979

The top of this crannog is almost circular with a diameter of only 5 m. The squarish base is 17 m across the widest point and 13 m across the narrowest. Its apparent small size is belied by the fact that it is one of the deepest of the Loch Tay crannogs with the top c 1 m below the surface and the bottom edge from 1·7 to 5·6 m deep. Why this crannog should be constructed on such a steep slope, 1 in 4 (25%), when all the others in the loch, except possibly no 2, are on very slight slopes is not clear, although silting may well have changed the profile of the loch bed in this area.

10. *Eilean Puttychan*, Eilean Sputachan (Island of the Little Spout) (fig 11). NN 582343
25 May 1979

This peninsula lies c 100 m W of Killin Pier, at the westernmost end of the loch. The loch is very shallow here due to extensive silting which has resulted in what was once an island becoming a peninsula. The mound is c 45 m in diameter and stands c 4 m proud of the water at the highest point. The whole mound is in very shallow water with c 1 m depth on the E side at the deepest point. Gillies (1938, 38) refers to a tack of 1568 by which Sir Colin Campbell of Glenorchy let lands of Morenish Wester to Patrick Campbell, brother to Duncan Campbell of Glenlyon. The yearly rent was to be 'a sheaf of arrows, if required' and the new tenant had powers to set six small nets around the island and to erect a stable on it. He also had to make his residence on the island or on the land of which it was a part. This is probably the westernmost of the three settlements shown in the loch on Mercator's map of 1620.

11. *Firbush Crannog* (fig 12). NN 602339
23 May 1979

Lying c 100 m off Firbush Point, this crannog is c 15 m in diameter with the highest point c 1·3 m below water level. The bottom edge is fairly even all round, the deepest point being 3·23 m below the surface and the shallowest c 2·8 m. On the bottom edge, particularly in the S and the SE, various timbers can be seen. The ends of many round timbers projecting radially from the centre of the crannog are exposed for a distance of over 6 m. Three distinct layers can be distinguished:

i. Thin branches c 0·15 m in diameter roughly in two layers overlying larger timbers.

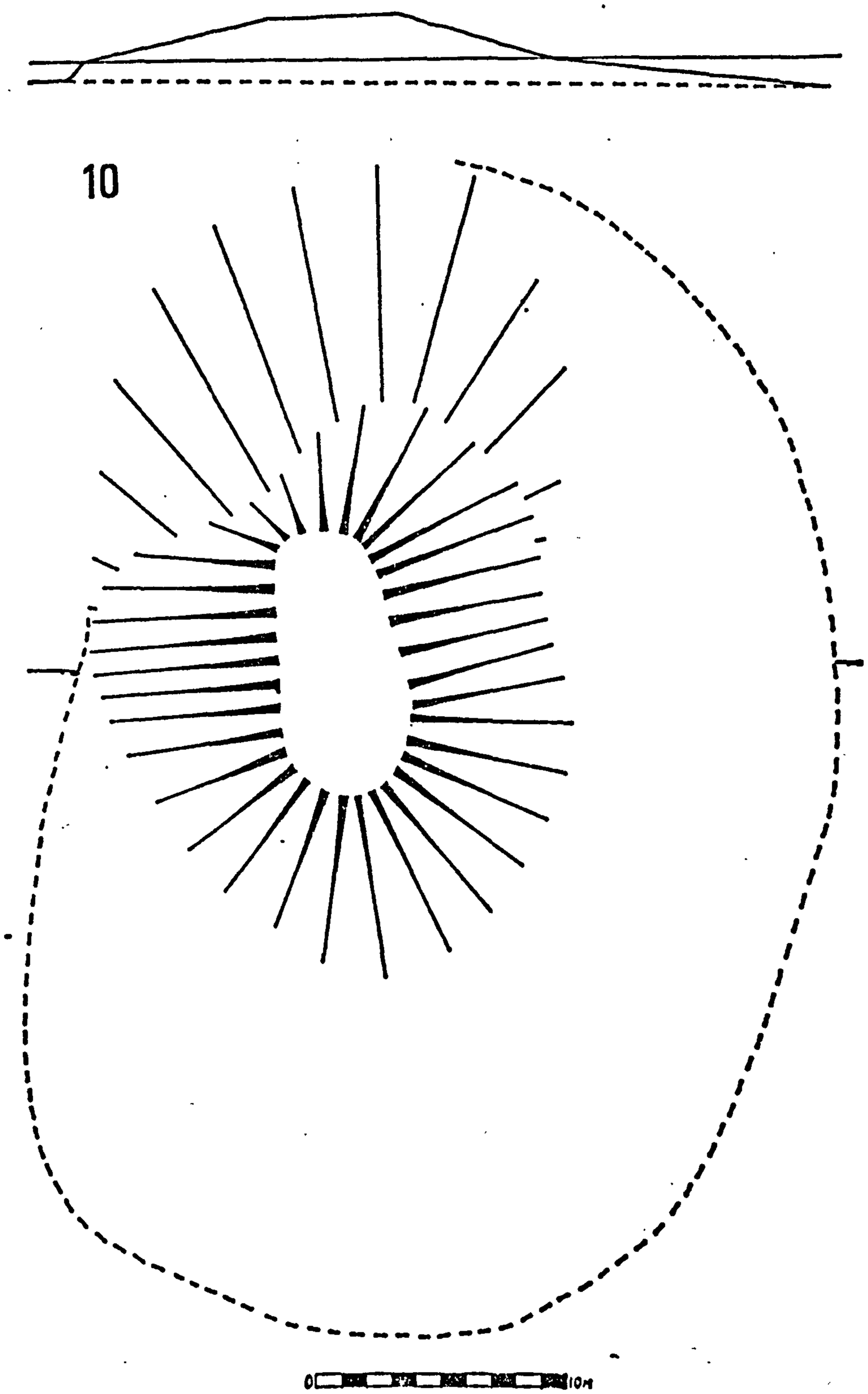


FIG 11 Eilean Puttychan: plan and section

ii. Large timbers c 0·4–0·5 m diameter lying horizontally and projecting from beneath the stones of the crannog.
iii. Horizontal branches c 0·1–0·15 m diameter lying at right angles to the large timbers below and in front of them. Evidence of cutting with a sharp tool can be seen on these branches.

Other single timbers can be seen around the base of the crannog.

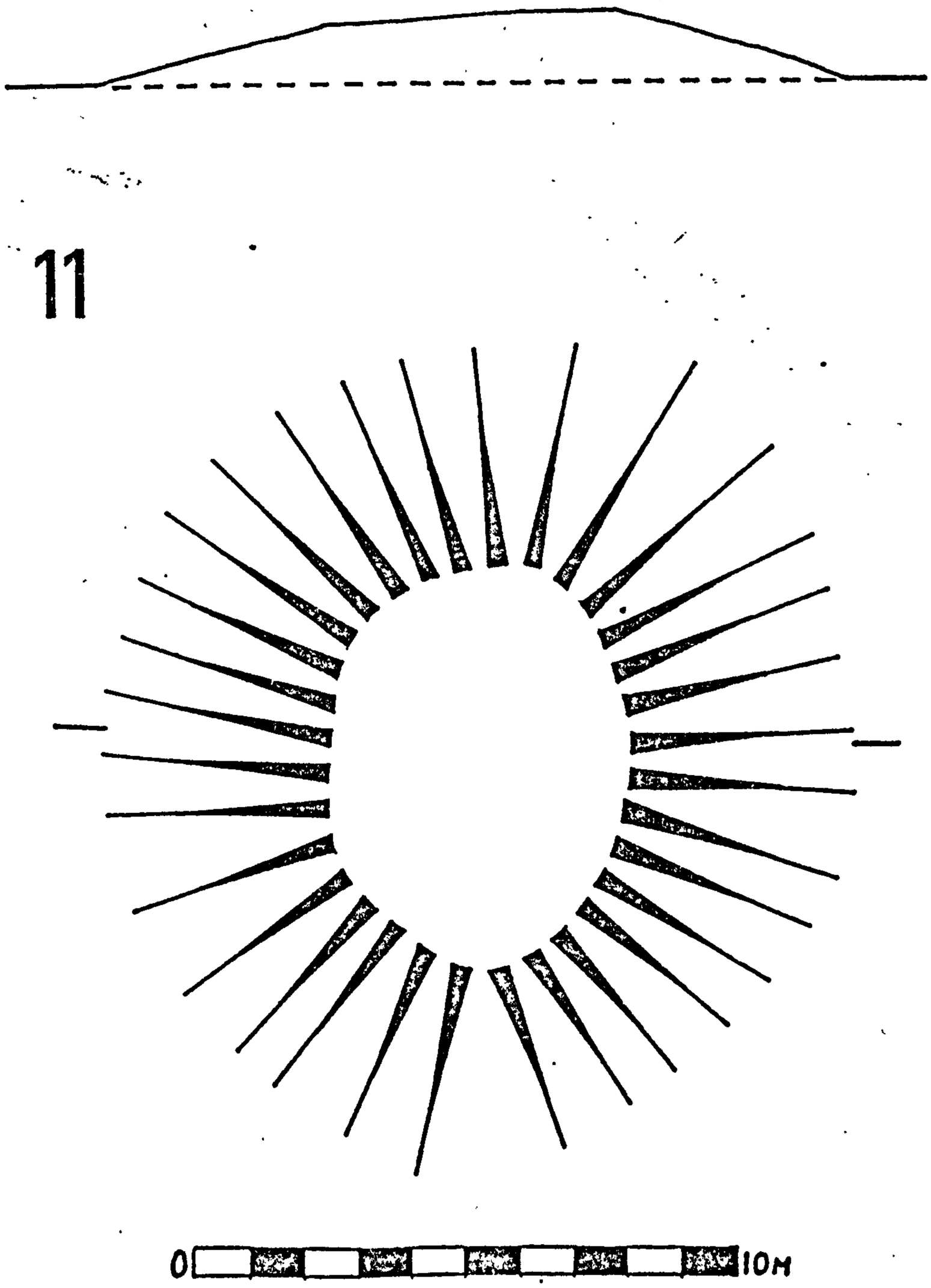
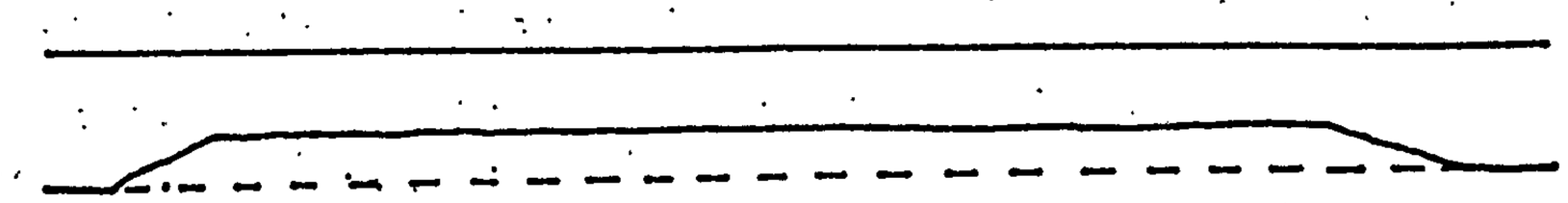


FIG 12 Firbush: plan and section



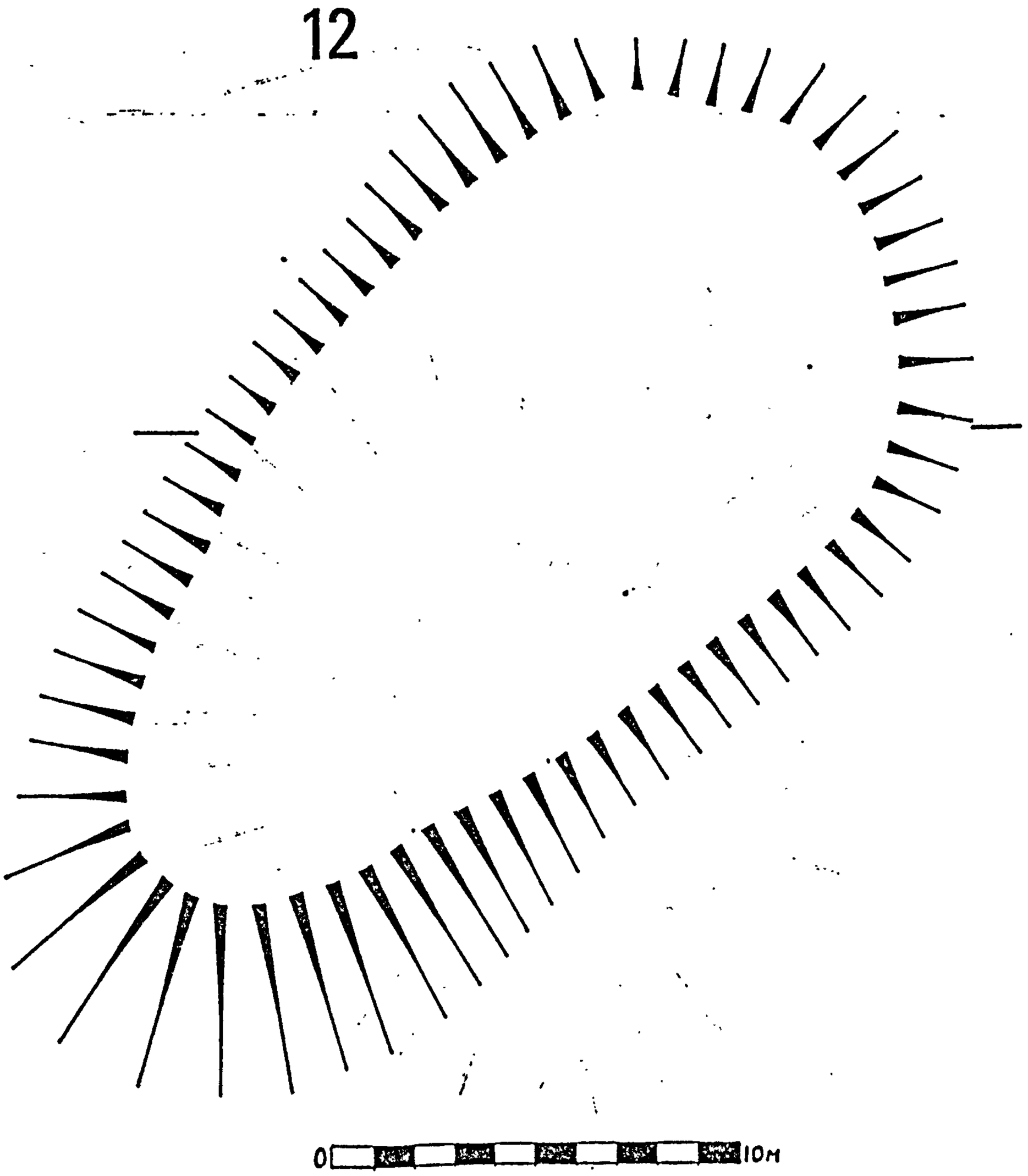


FIG 13 Craggan: plan and section

12. *Craggan Crannog* (fig 13). NN 664360
25 May 1979

This crannog is elongated with a N–S axis, and is c 15 m from the end of the pier at the Craggan Boys' Brigade Centre. The top of the crannog at the S end nearest the shore comes to within 0·5 m of the surface and is exposed in summer, while the bottom edge at this point is c 1·5 m below the surface. At the N end the top of the mound is c 2 m below the surface, dropping down steeply to c 3·75 m at the bottom edge. The crannog is c 30 m long and c 16 m across. On the top of the mound, among and projecting from the boulder make-up, can be seen oak timbers which appear to be part of the structure. These include horizontal beams and vertical piles.

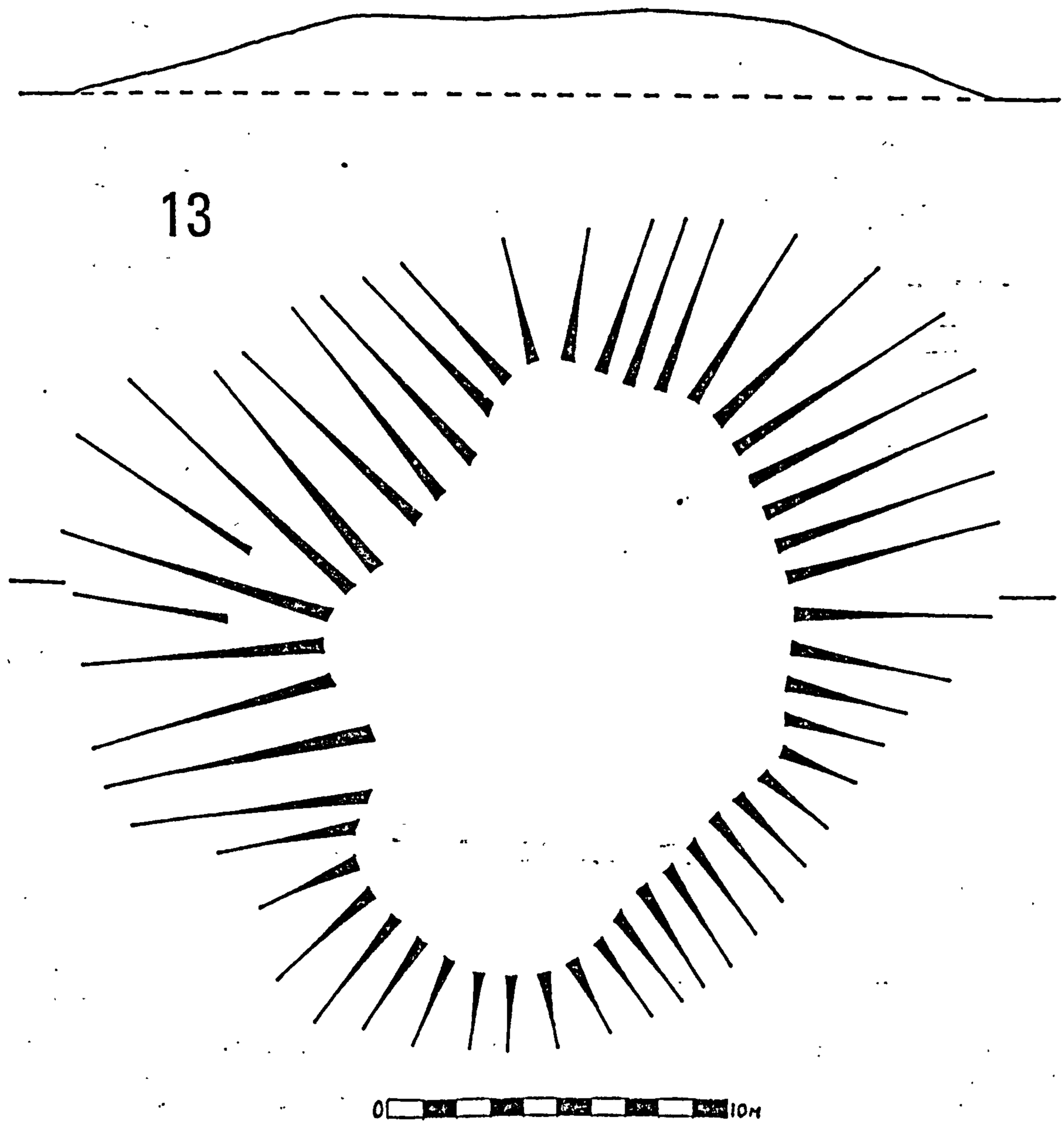


FIG 14 Dall Farm: plan and section

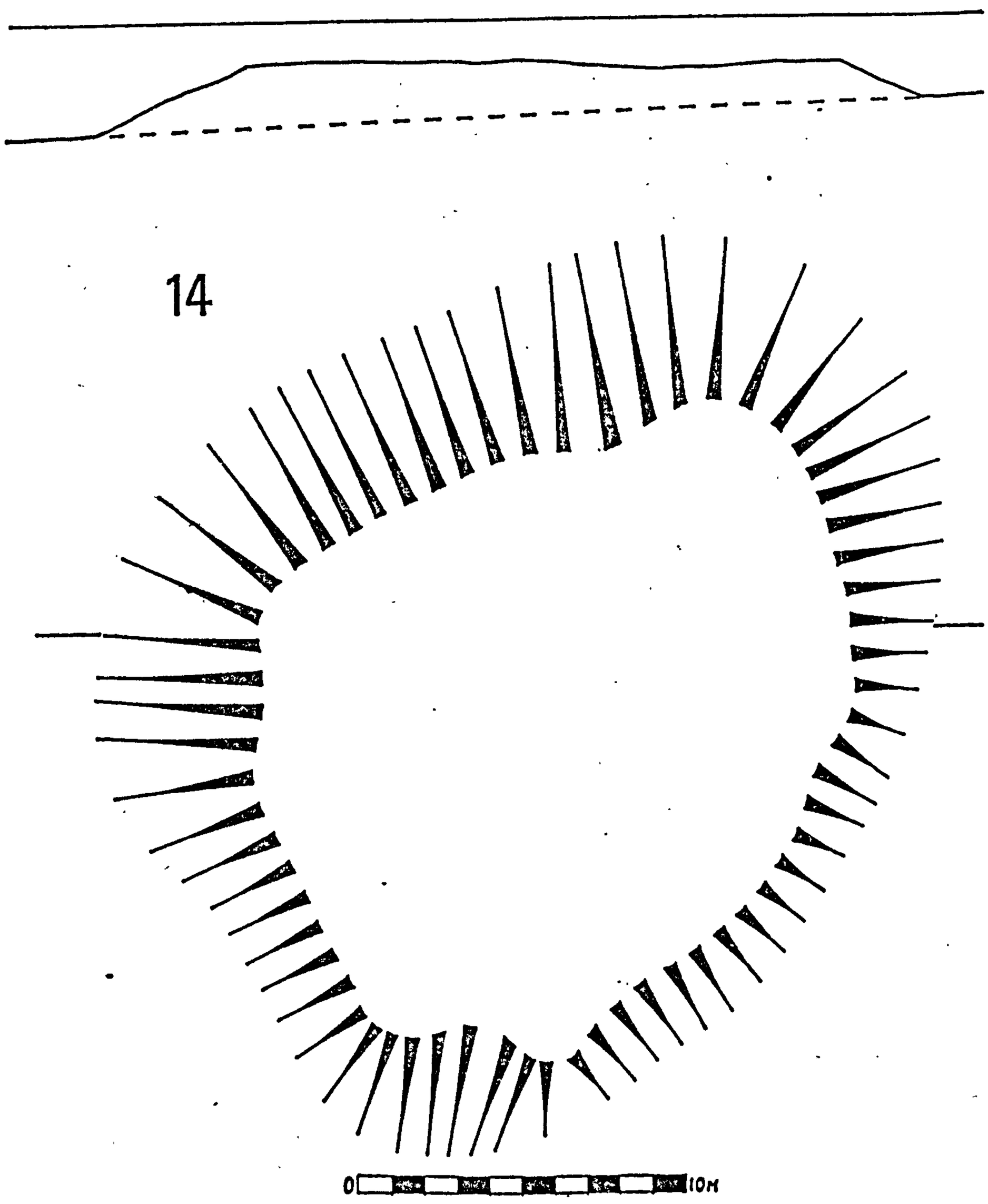


FIG 15 Dall Farm South: plan and section

13. *Dall Farm (North) Crannog* (fig 14). NN 672363
3 June 1979

There are two crannogs c 150 m apart and c 50 m offshore at Dall Farm of which the more northerly lies substantially deeper than that to the S. The N crannog is oval with the longest axis c 30 m across and the shortest c 24 m. The top of the mound is c 18 m by 13 m the highest point being 1·5 m below the surface, sloping down to 3 m. The bottom edge of the crannog is at a depth of 3·2 m in the S and 5·4 m in the NW.

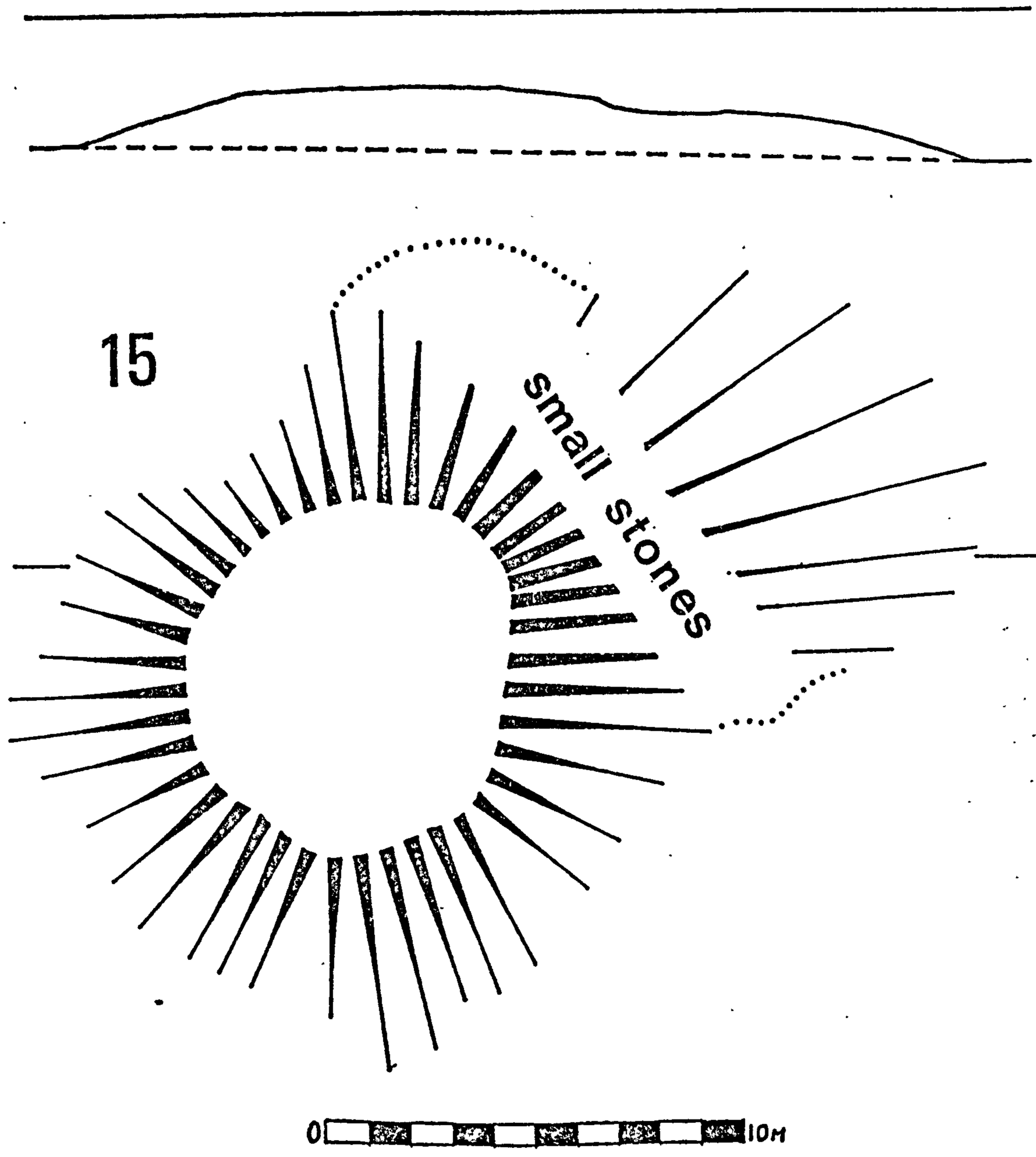


FIG 16 Old Manse: plan and section

14. *Dall Farm* (*South*) *Crannog* (fig 15). NN 674362
1 June 1979

This crannog is also 30 m by 24 m but the top is 22 m by 17 m sloping from 0·75 to 1·5 m below the surface. The bottom edge varies in depth from 1·6 to 3·8 m. On the top can be seen timbers among, and projecting from, the stones which constitute at least the outer fabric of the crannog. Between some of the timbers was a scatter of burnt bone in a deposit of organic material apparently consisting of bracken and moss.

15. *Old Manse Crannog* (fig 16). NN-682371
3 June 1979

This crannog is c 70 m directly out from the jetty of the old manse and church just N of Margbeg. The mound is roughly rectangular on a NE–SW axis, 22 m by 14 m, with a bulbous extension to the W, but the top area is roughly circular and towards the E end of the structure. The bottom edge varies in depth from 2·8 m in the S to 4·2 m in the N, and the top edge varies from 1·8 to 2·2 m with the highest point of the top 1·74 m below the surface. The bulbous extension to the W is c 2·6 m below the surface and is delimited from the main top area by a band of much smaller stones than those in the rest of the crannog surface. Directly beneath these smaller stones was a layer of small pieces of wood and organic debris. The extension may represent the remains of a pier or other feature.

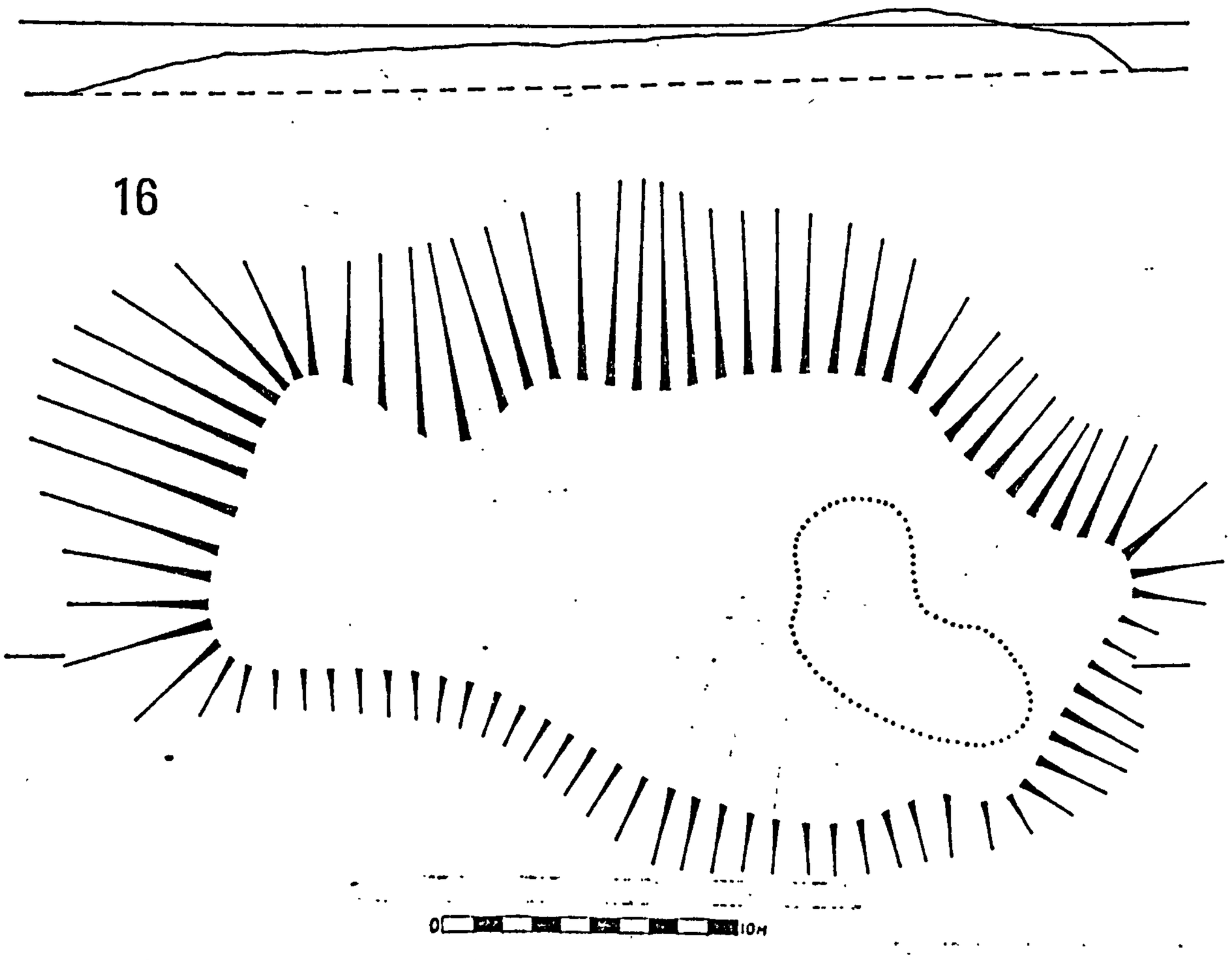


FIG 17 Croftmartaig Island: plan and section

16. *Croftmartaig Island* (fig 17; pl 2c). NN 751437
28 May 1979

Part of this crannog is exposed all year round, but the exposed area belies the true shape of the structure. The area above the surface is roughly circular, standing no more than 1 m clear of the water, while underwater the mound extends to the SW almost the same distance again; the SW end is flattened (pl 2c). The exposed area measures c 25 m along the long axis and the whole crannog is c 42 m long by c 26 m wide. The underwater section may be an addition, or the original structure which has been added to, the join being seen as a narrowing across the waist of the mound. Alternatively, the lower SW area may have been some form of pier or small harbour for landing and mooring boats. On the S and E sides the water is

c 1·5 m deep while on the N and W sides the loch bed slopes down to c 4 to 5 m. Some traces of timbers were seen on the loch bed on the N side of the island but not definitely directly associated with the crannog.

17. *Spar Island*, Spray Island, Spry Island (fig 18). NN 773452
1 June 1979

This island is exposed all year round and stands to a height of c 3 m above the average water level at the E end of the loch. Above water it is 40 m by 15 m, the long axis running E–W. Modifications in shape and size were carried out by the Marquis of Breadalbane for a visit by Queen Victoria in 1842. Remains of a

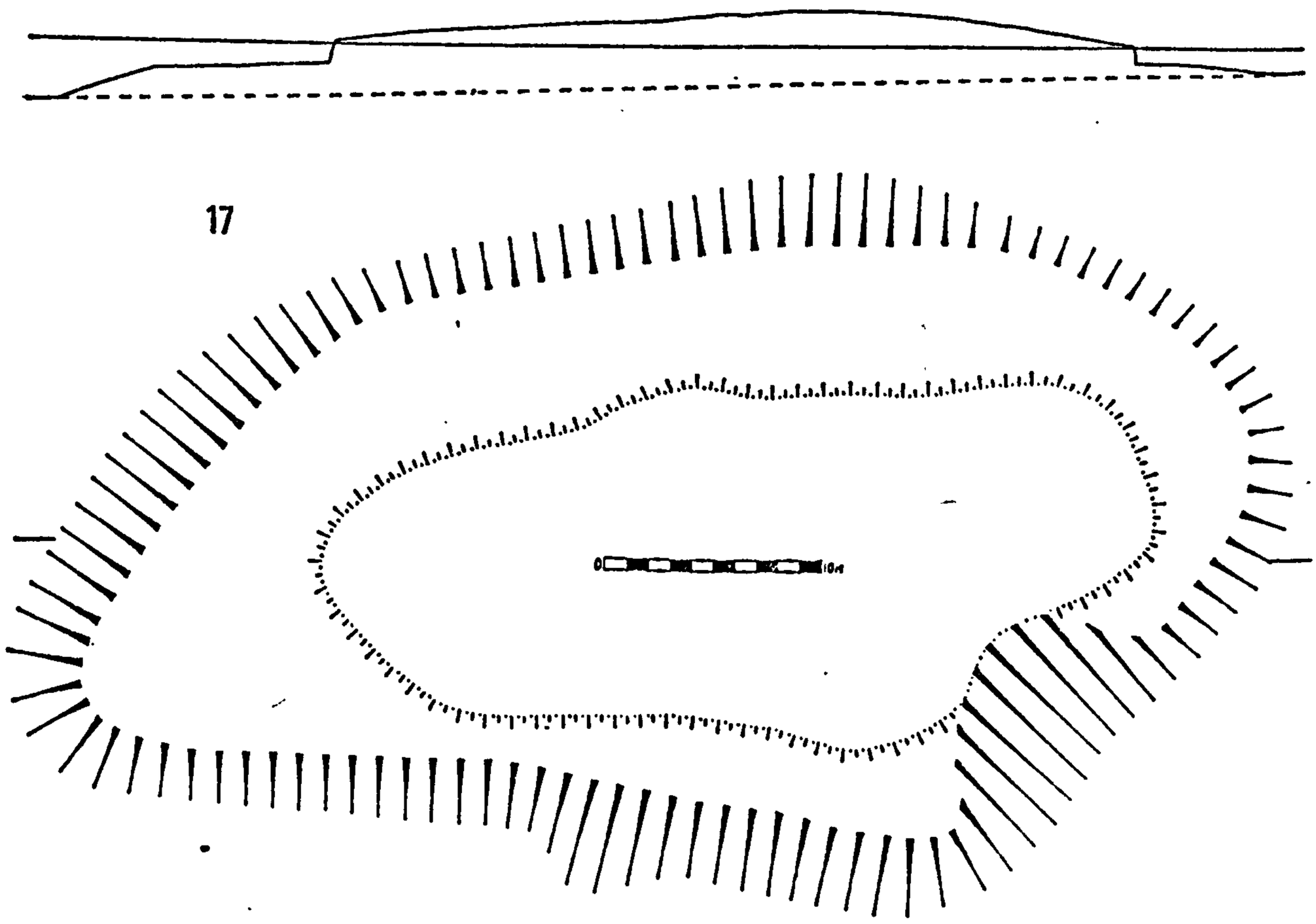


FIG 18 Spar Island: plan and section

wall can still be seen on the W side dating from these modifications, and mature trees planted then still flourish here. The composition of the island shows it to be artificial but no timbers could be seen which were definitely of the original structure. The water is 1 to 1·5 m deep on the SE and NE sides and c 3 m deep on the NW and SW. This is an area of fairly rapid silting so the top of the mound may once have been higher above the loch bed than at present. This island was planned at 25 in to the mile by the OS and also appears on Blaeu's Atlas.

ACKNOWLEDGEMENTS

Assistance and encouragement of all sorts were given by Prof D Harding and Dr I Morrison of the University of Edinburgh. Essential equipment was supplied by the University Sub-aqua Club and Dr T Scoffin of the Geology Dept. Thanks are also owed to the Physical Education Dept, in particular Colin Cruickshank and Miss Mustard, and Mr and Mrs Ross at Firbush

Outdoor Centre. A special thanks is due to the divers and archaeologists who worked in very cold and trying conditions but stayed cheerful and efficient throughout.

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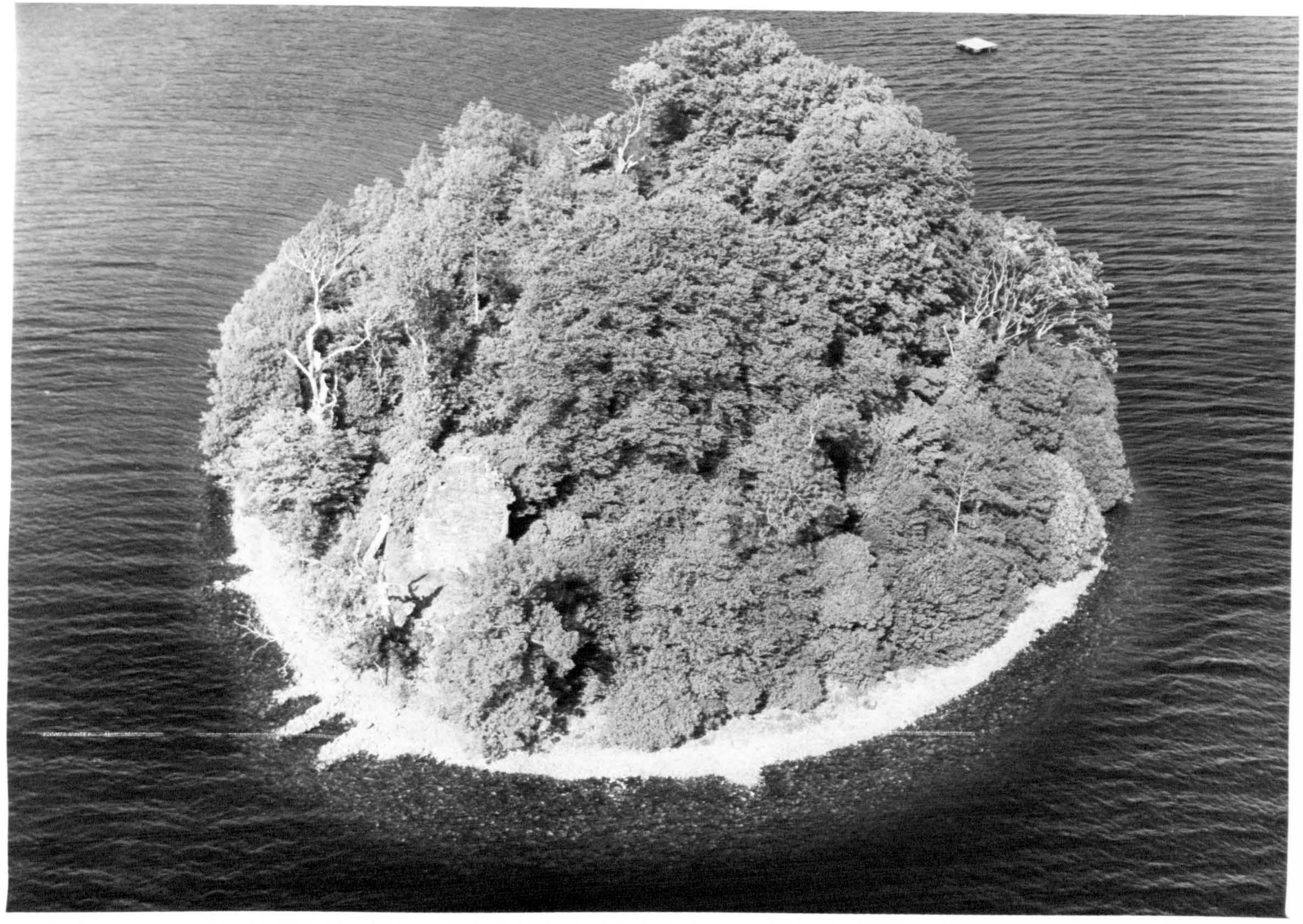


Plate A1

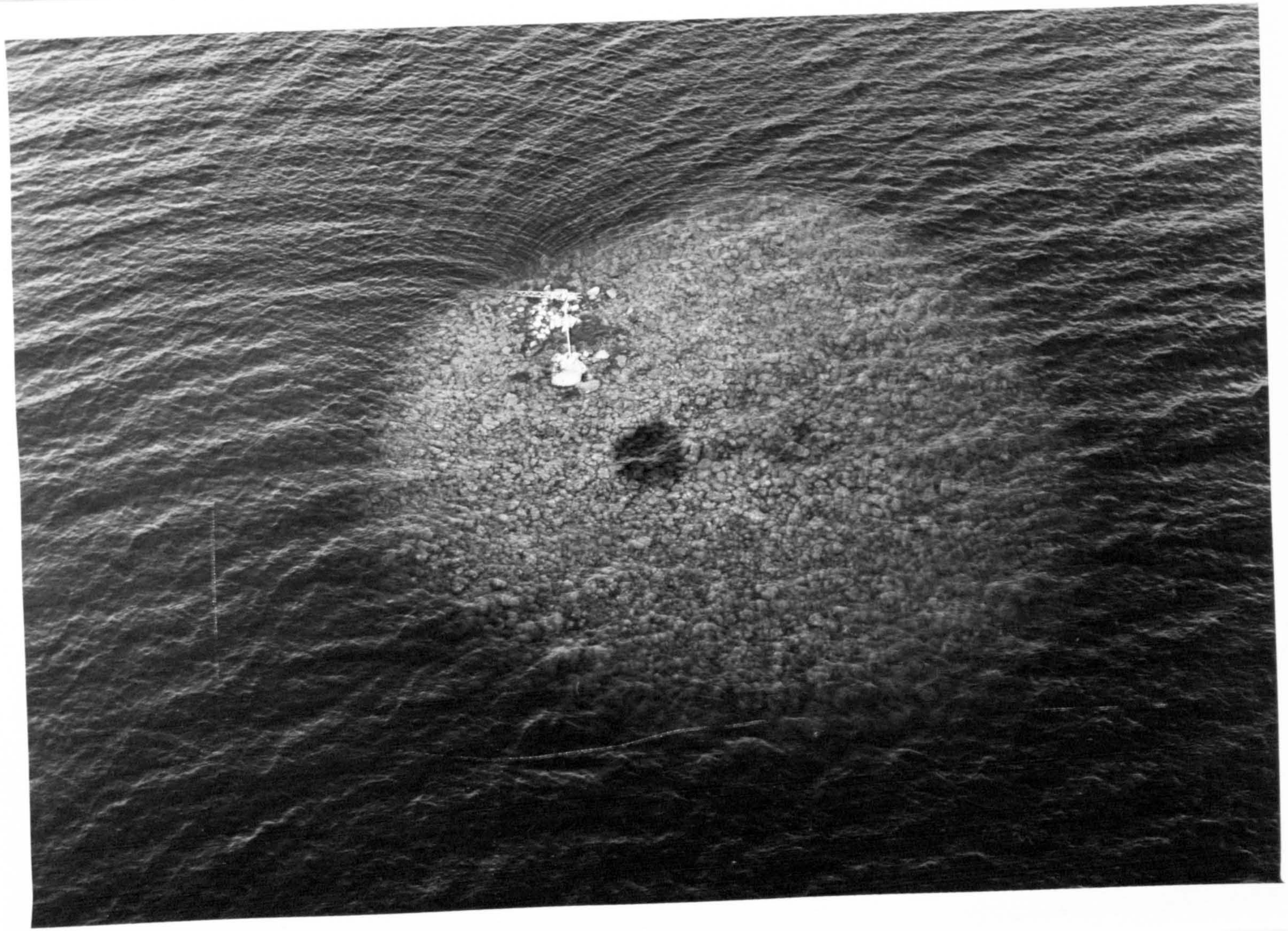
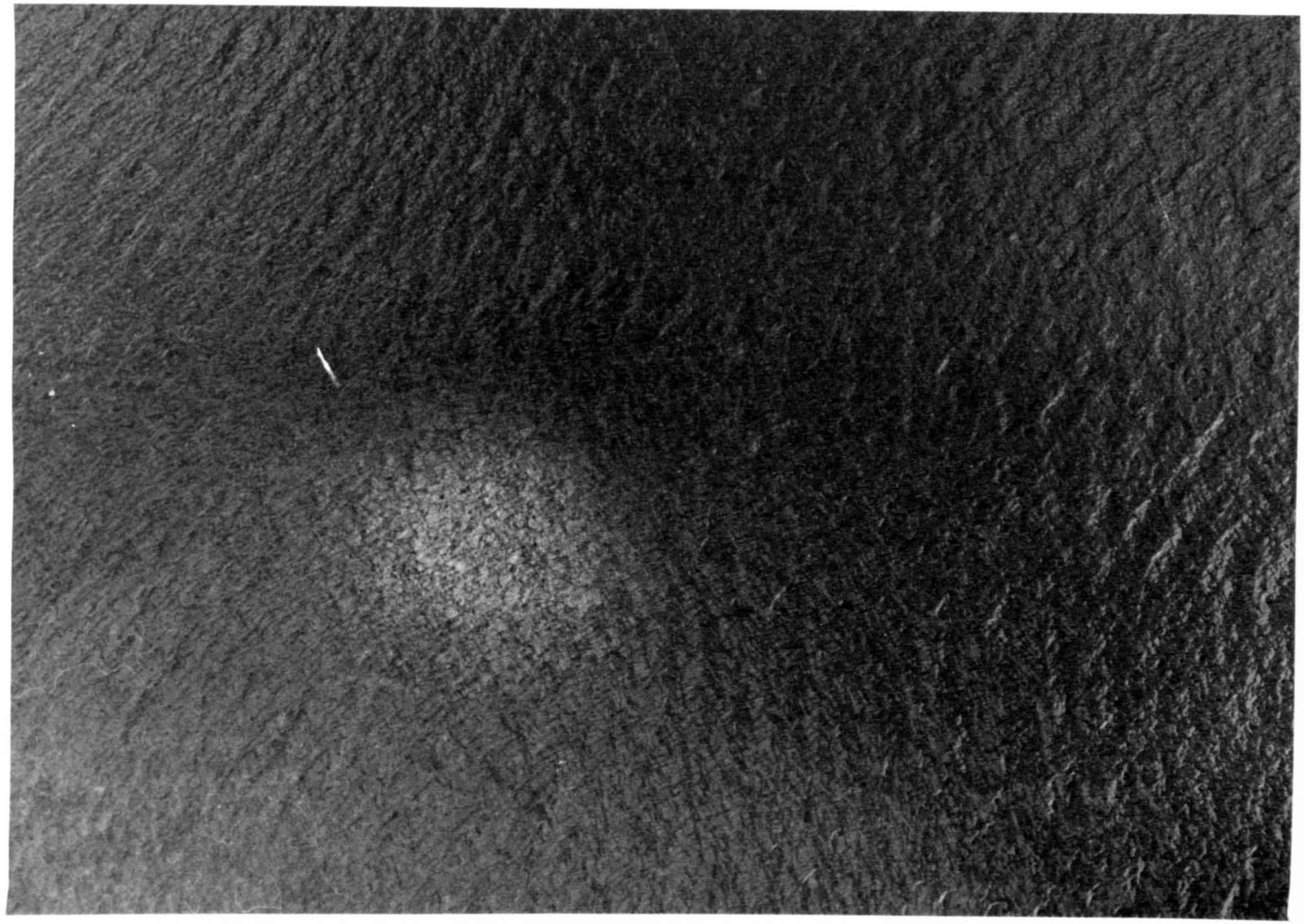


Plate A2

Plate A3

Plate A4



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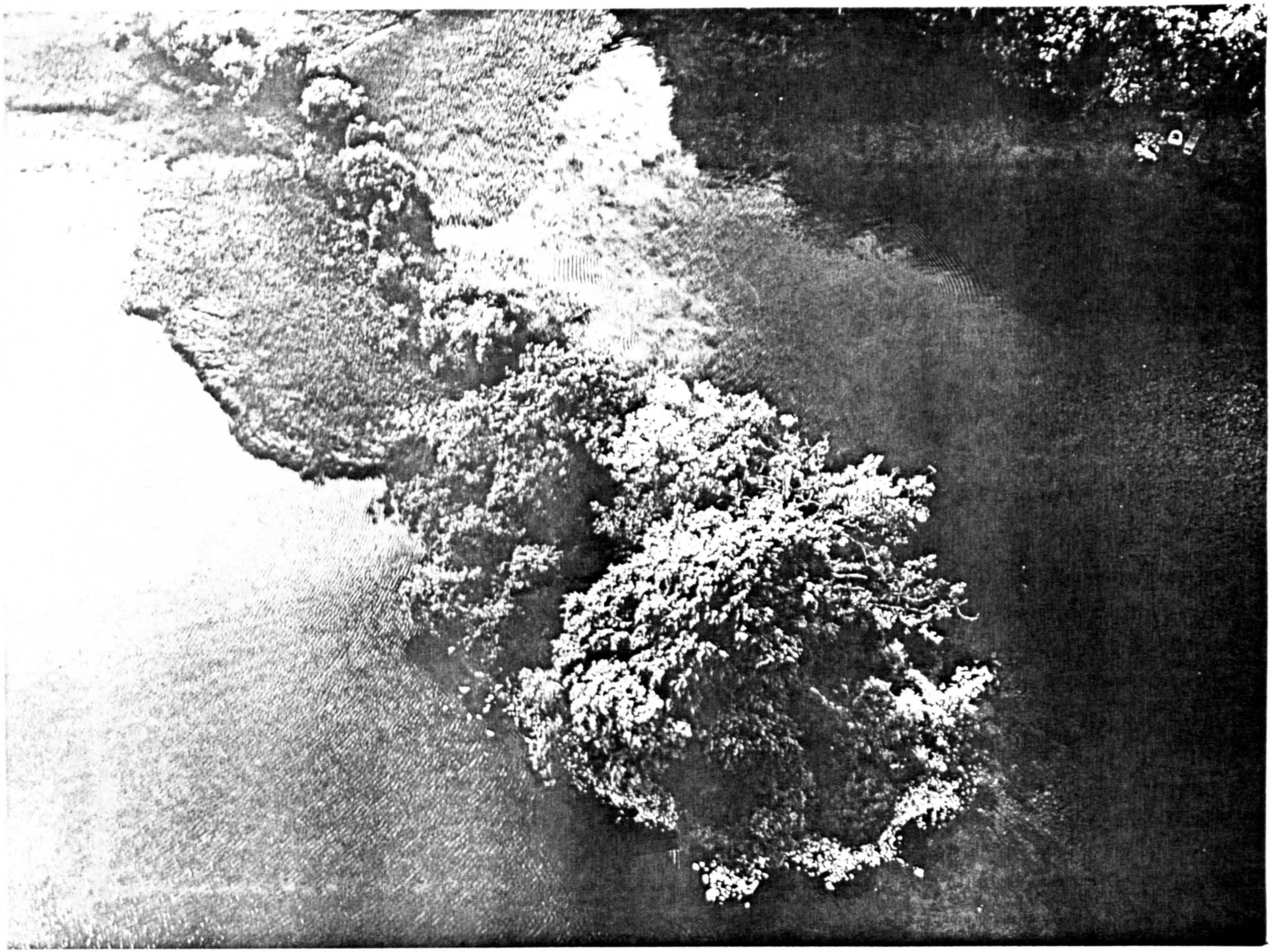


Plate A6

Plate A7

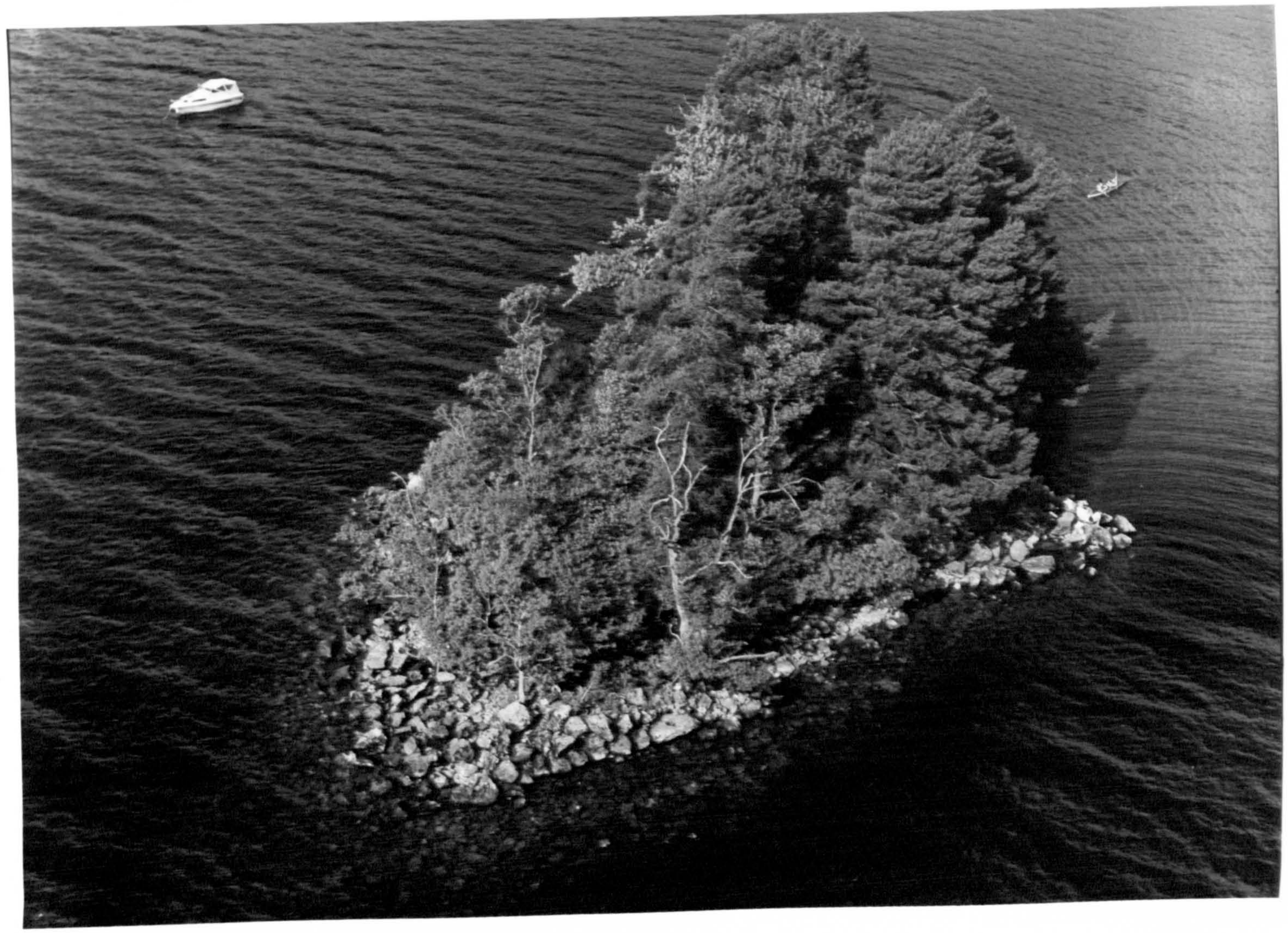


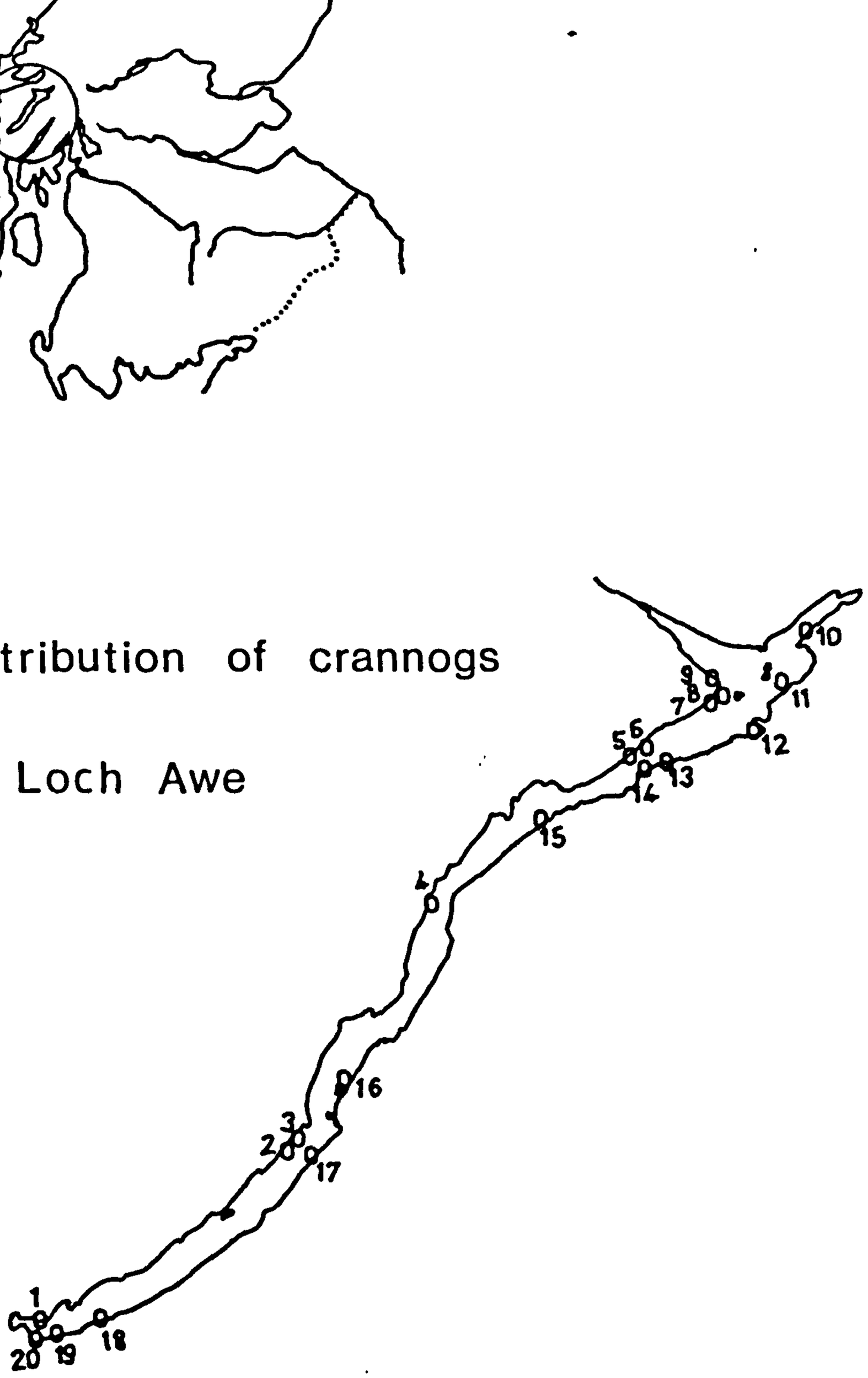
Plate A8

position of

Loch Awe

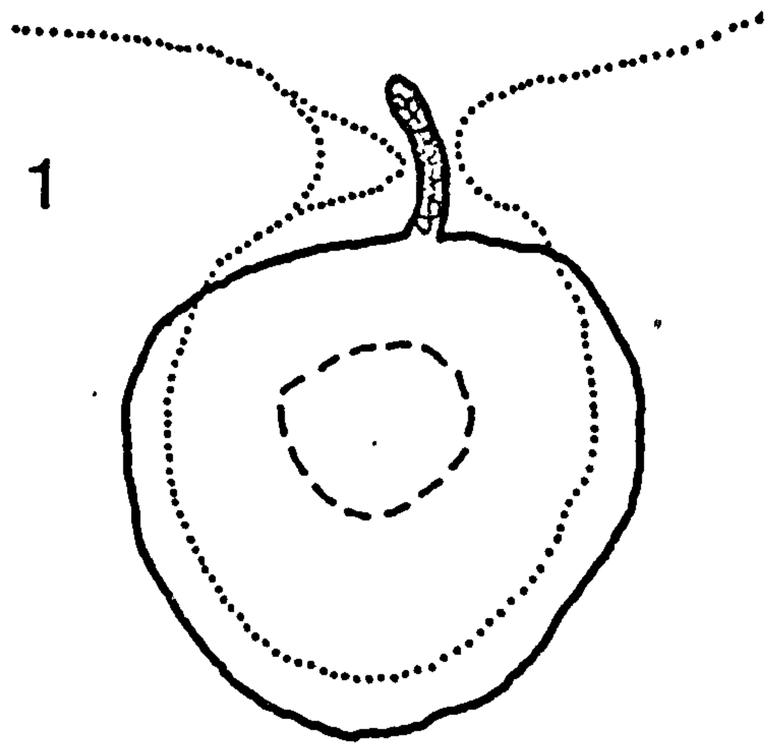
distribution of crannogs

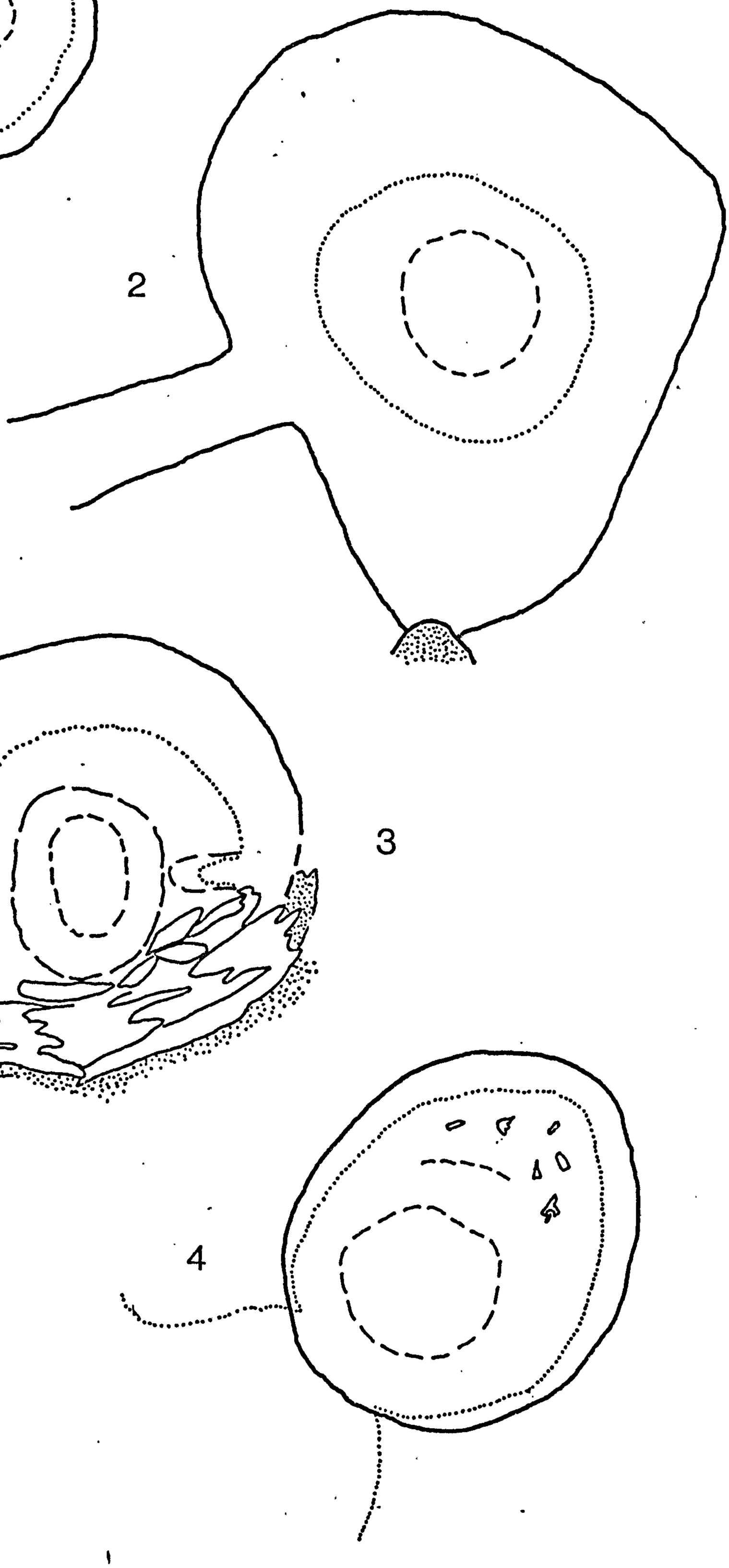
in Loch Awe

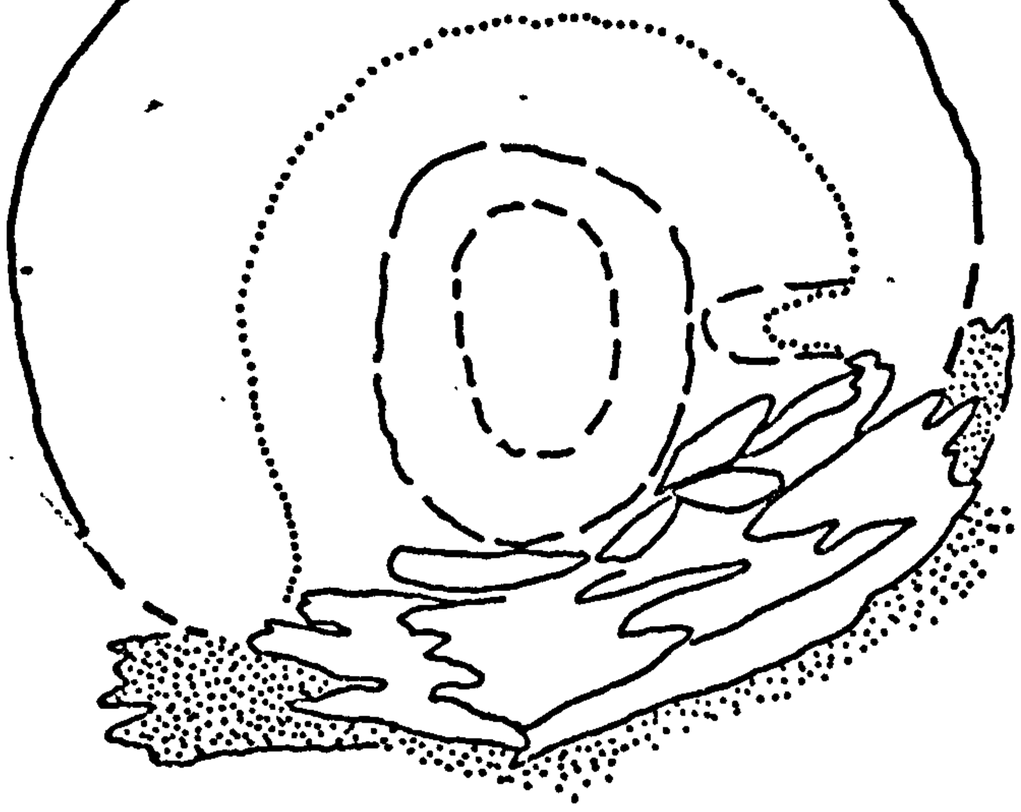


Loch Awe

1:500







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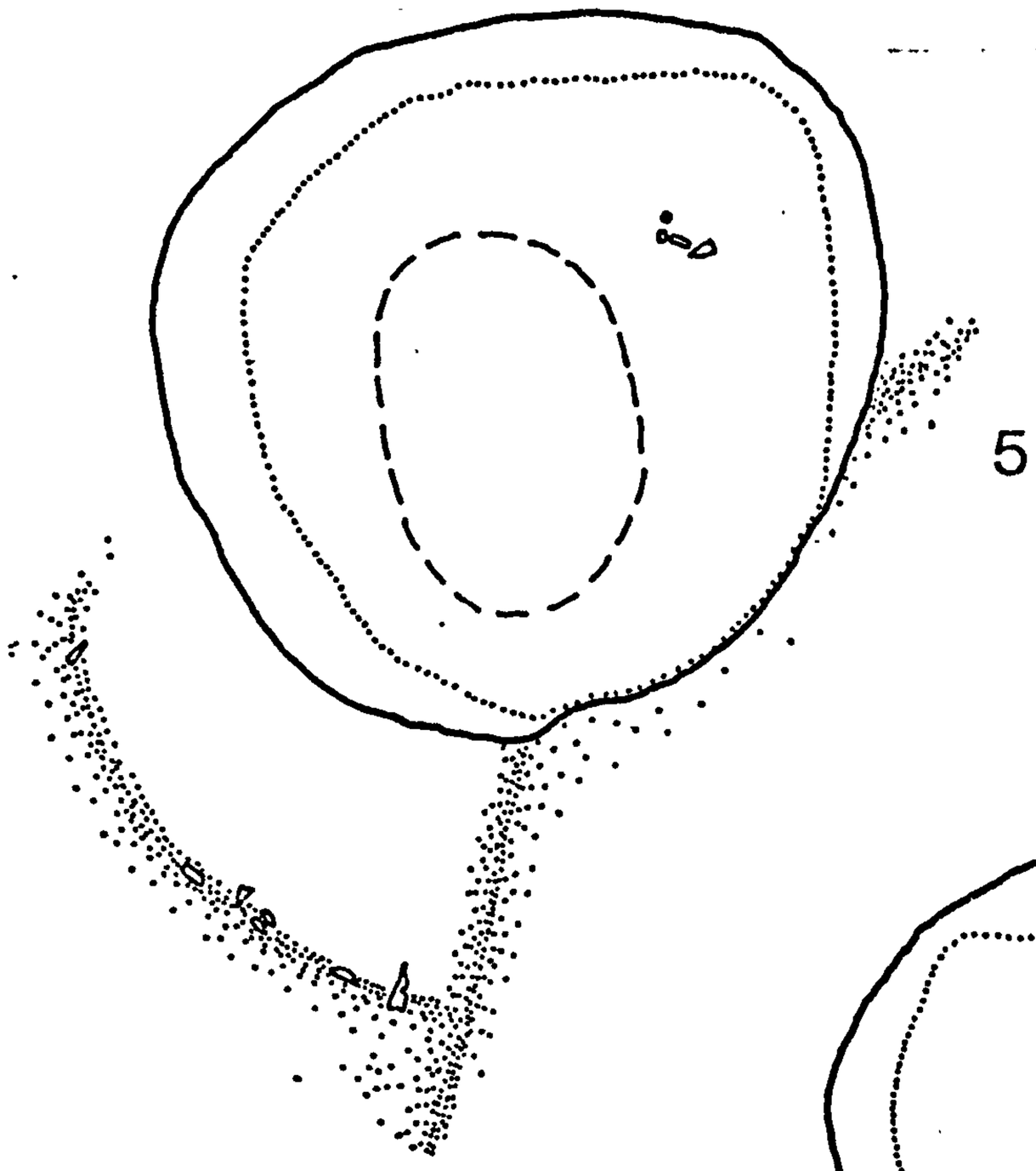

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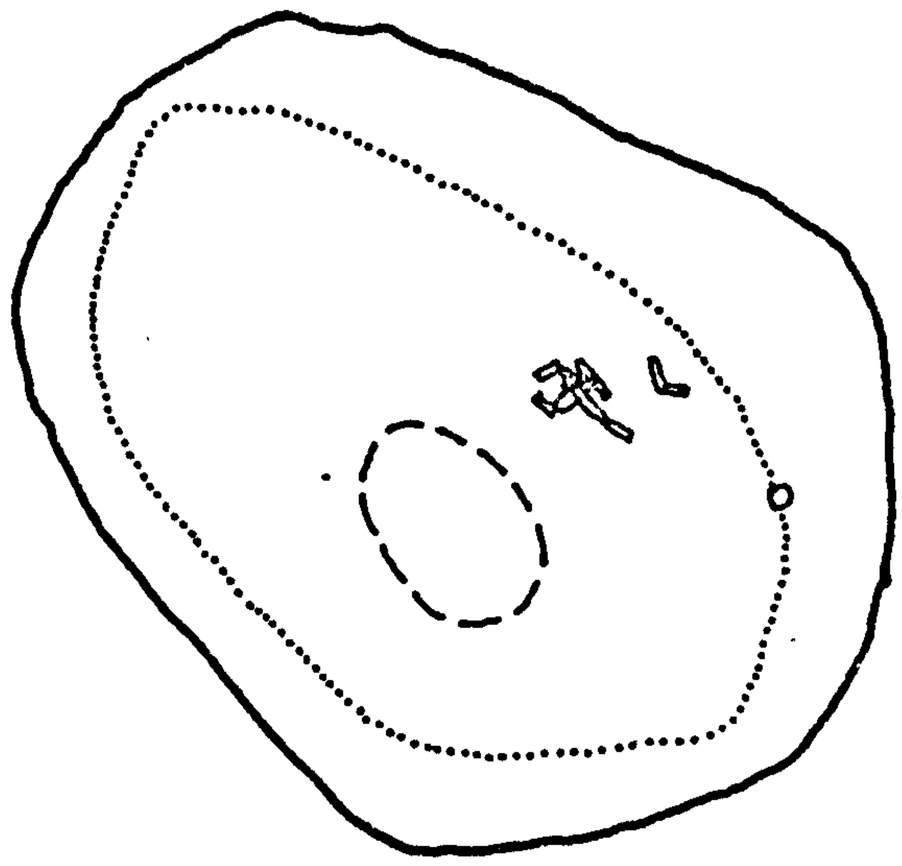

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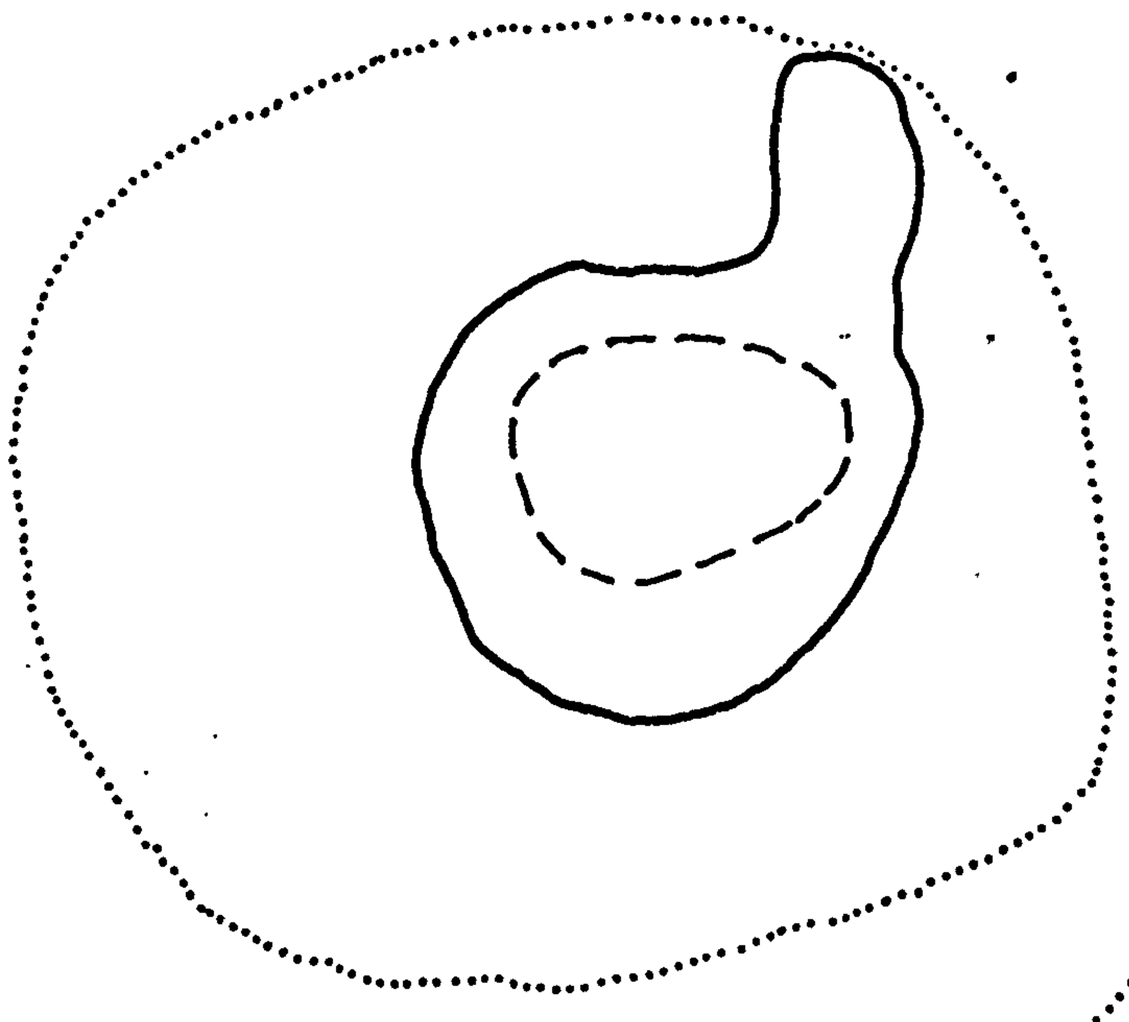

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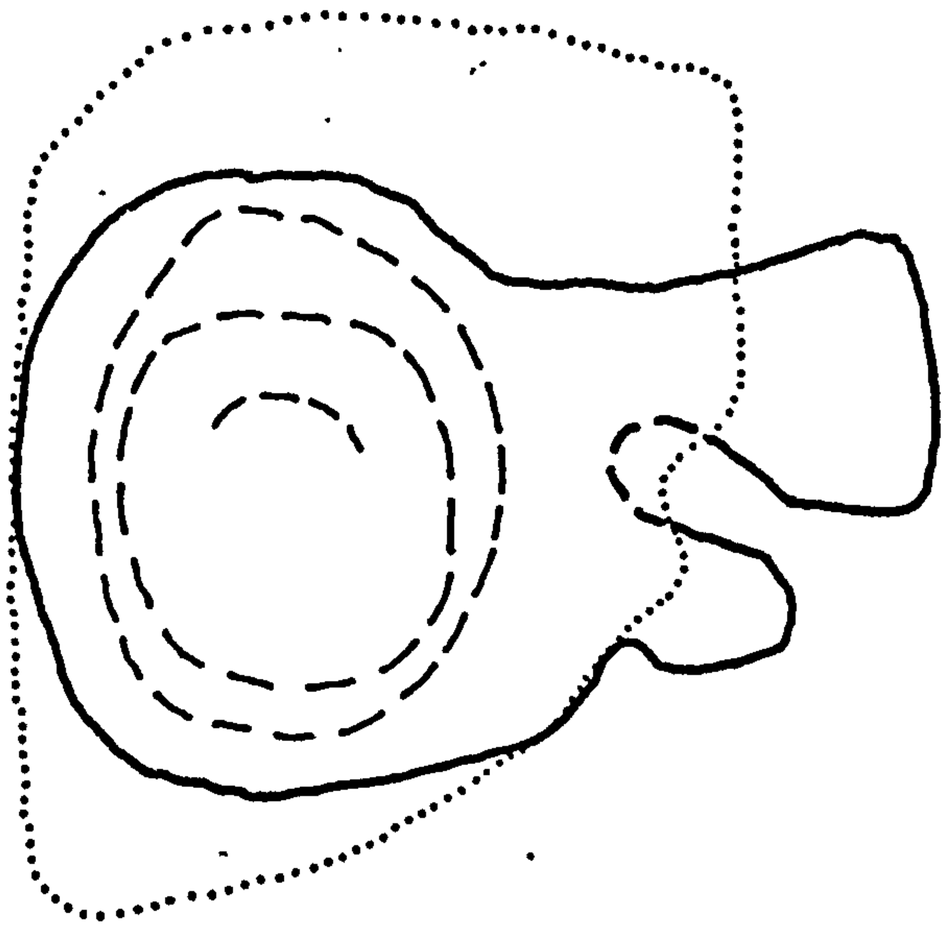

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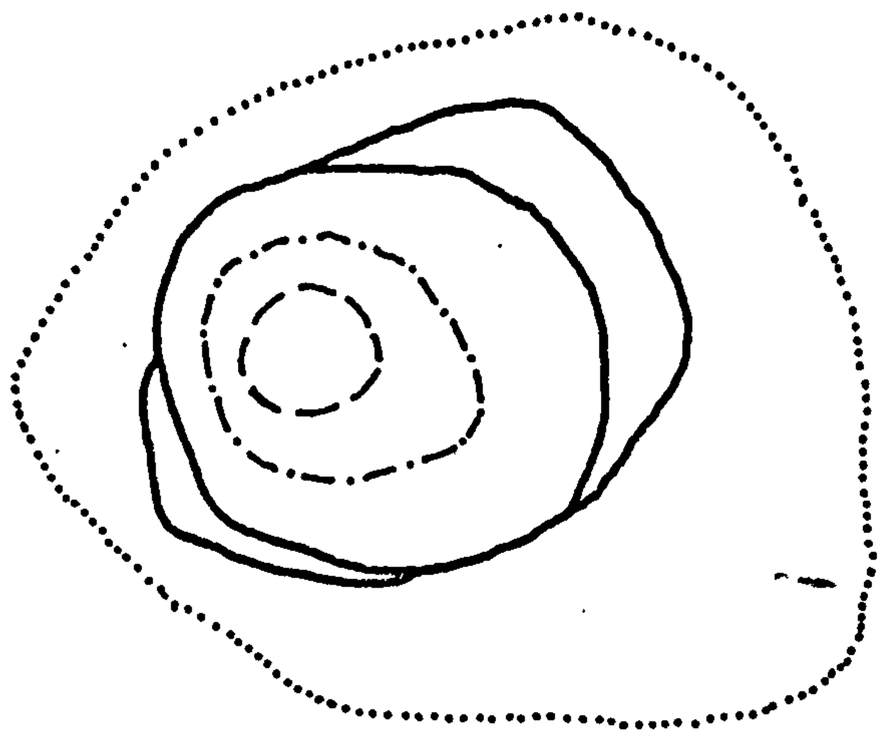

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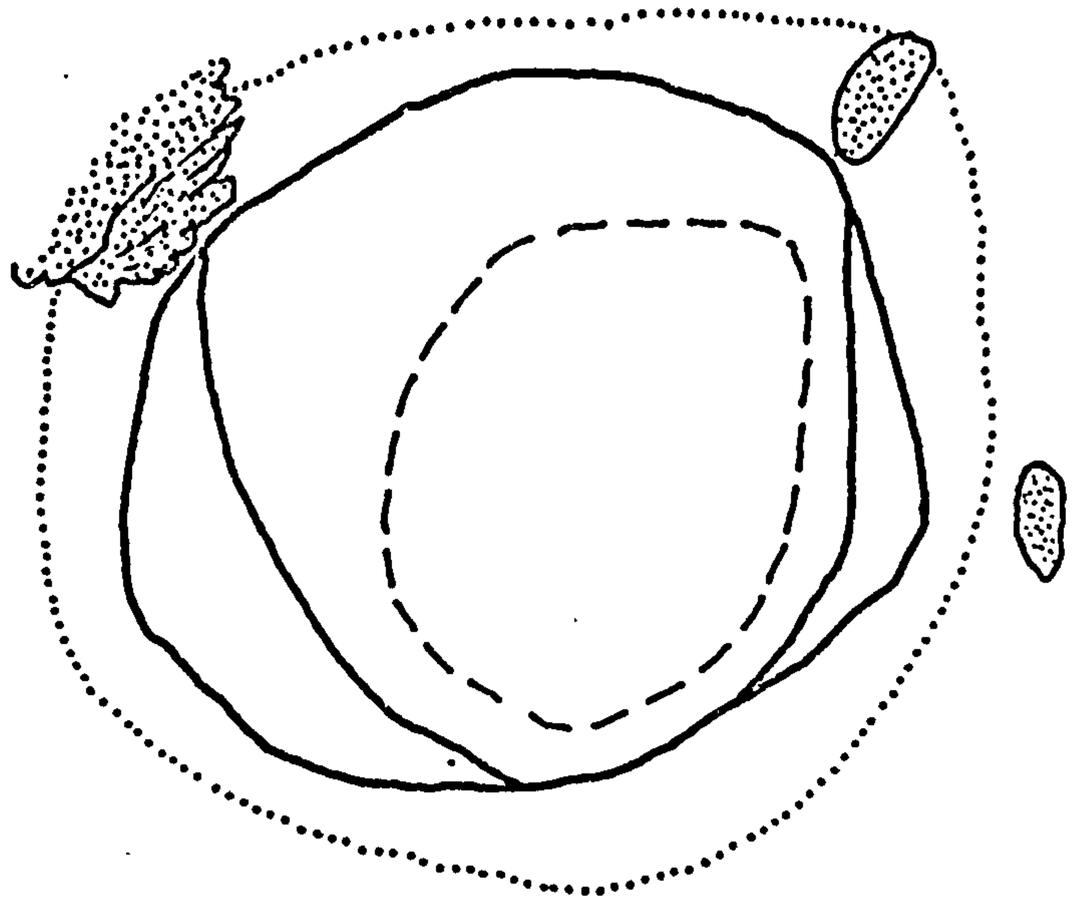

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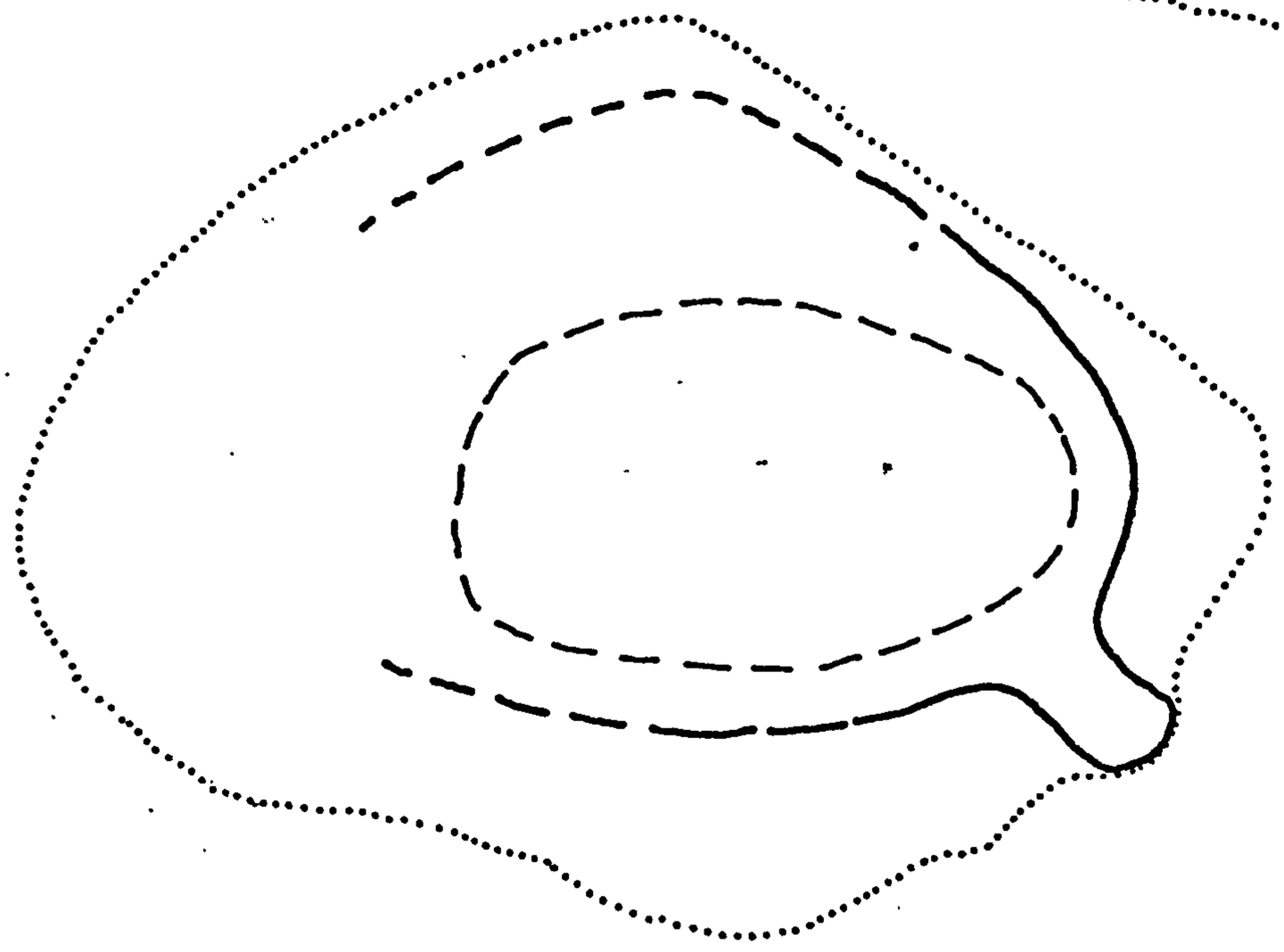

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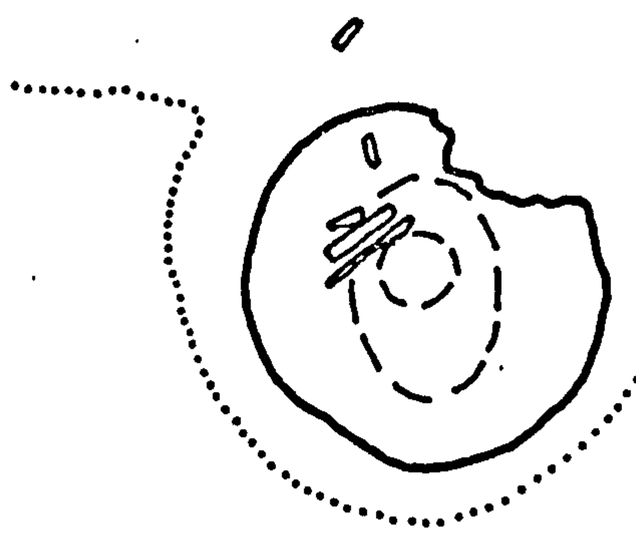

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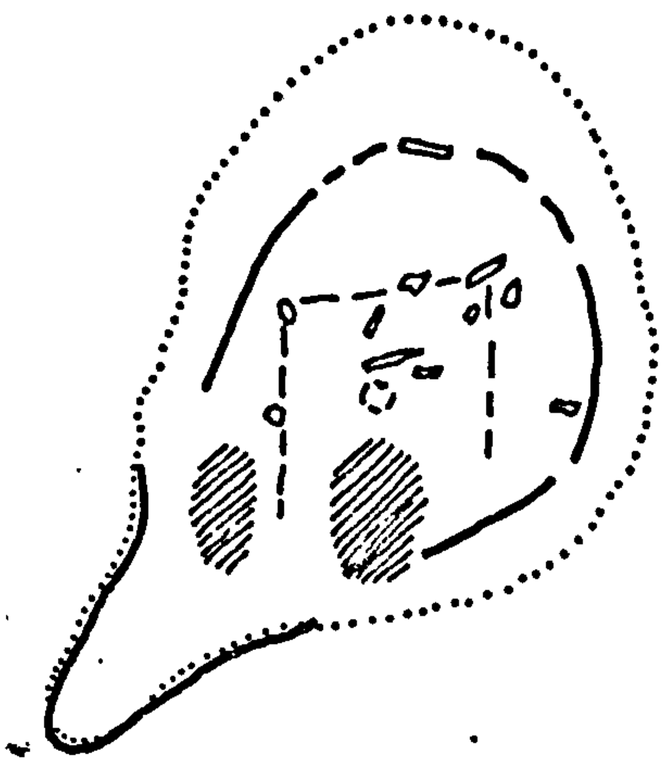

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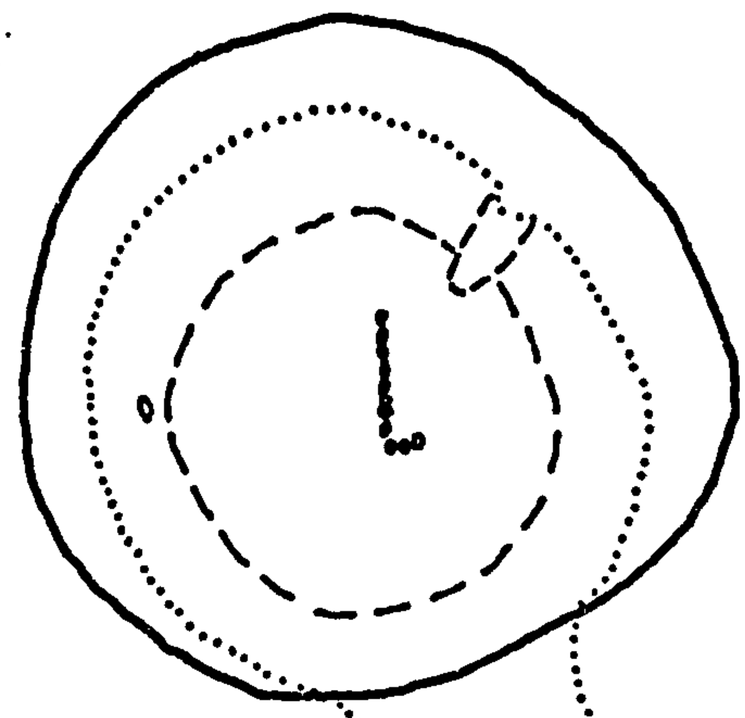

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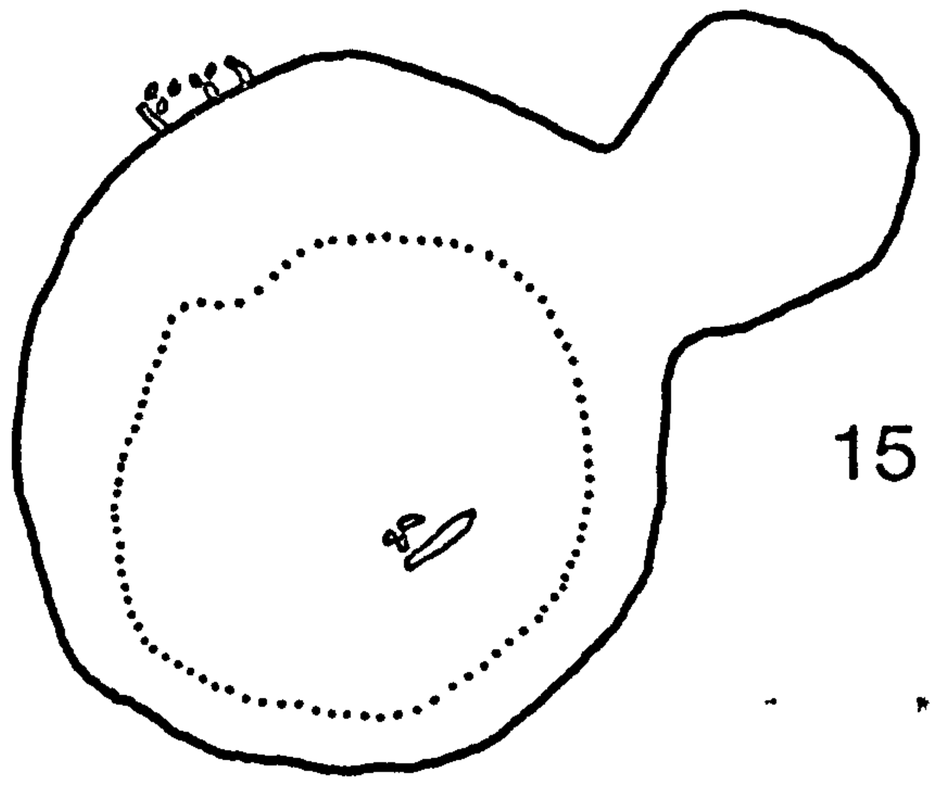

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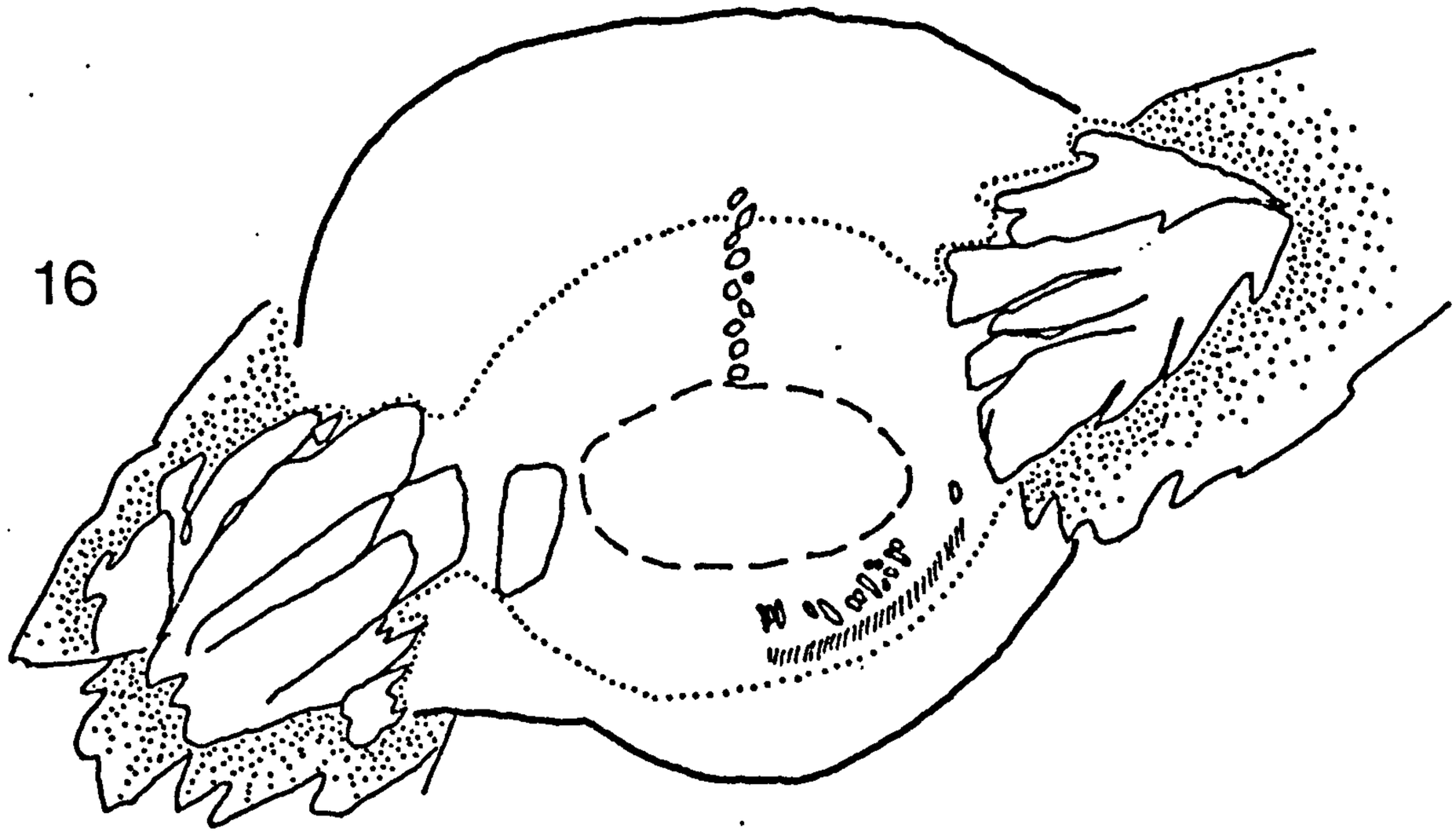

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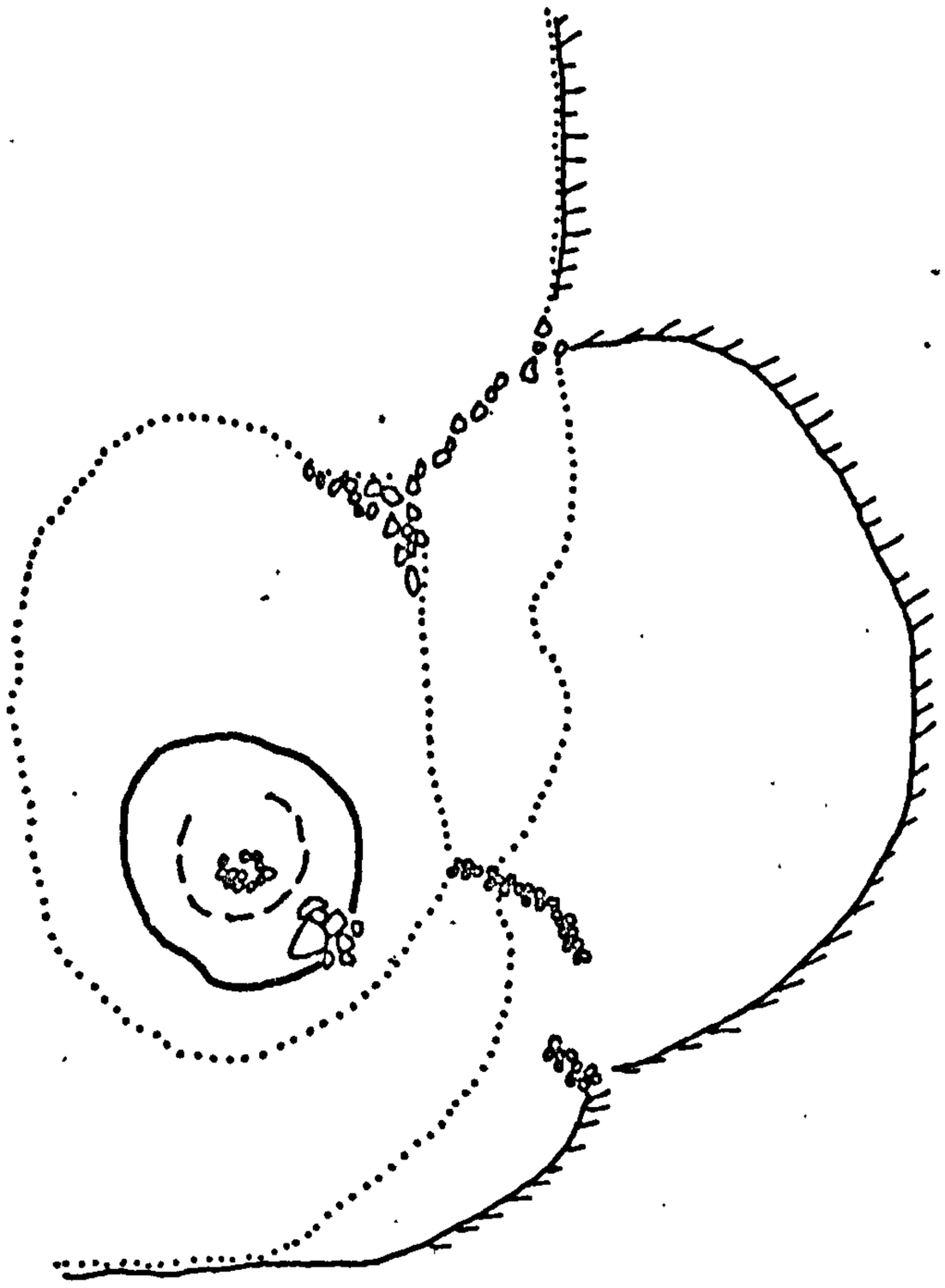
Loch Awe



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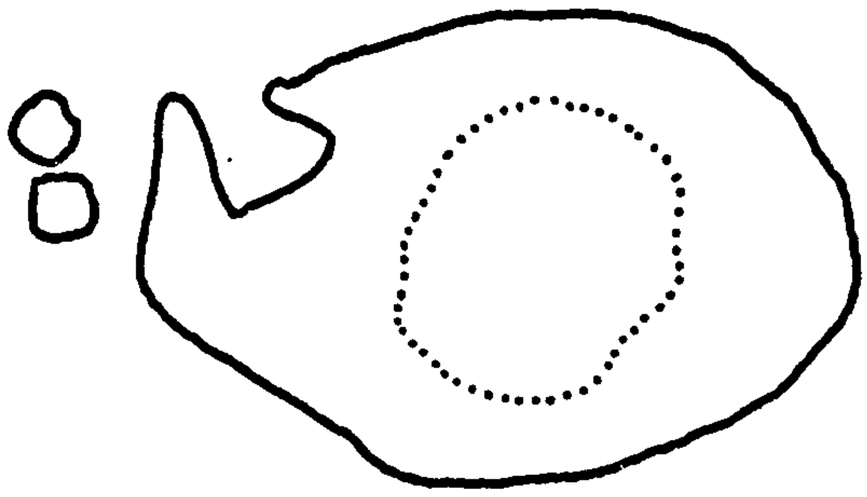

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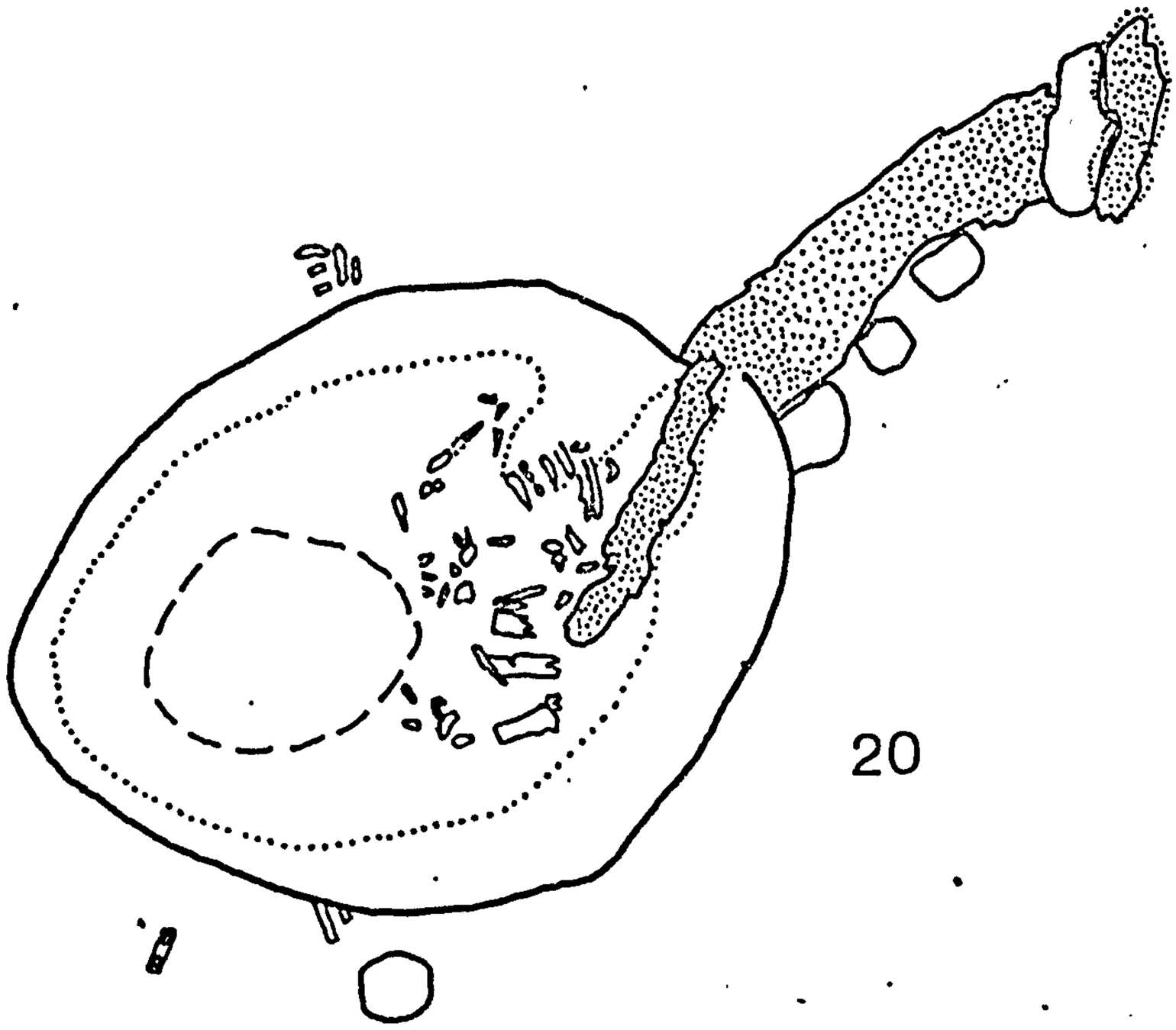

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Appendix B.

PUTATIVE FEATURES REPRESENTED BY PILES ON OAKBANK CRANNOG.

(See figures 25 and 27).

F1.

Curving row of uprights. Possibly house outer wall or walkway foundation and/or stockade supports. East flank. (88, 12, 100, 44, 133, 112.)

F2.

Curved row of uprights. Possibly house outer wall etc. as above but west flank. Not so regular as F1. (478, 475, 476, 474, 485, 486, 486a. Possibly 489 and 380. 504 may be either part of F2 or F6.)

F3.

Large pile flanked by 3 smaller uprights on south, southwest and west. Possibly east `doorpost' structure. At west end of F1. (116, 135, 124, 109.)

F4.

Large pile (379) flanked by 3 or 4 smaller uprights on east, south and west. Possibly west `doorpost' structure at southeast end of F2. Complementary to F3.

(379, 376, 378, 385. Possibly 384 or F6. Poss 380 or F2.)

F5.

Possibly outer wall of house and/or inner walkway supports.

East side.

(171, 172, 62, 22, 77, 166, 165, 132, 129, 117, 130, 118, 15, 19, 134, 128, 67, 24, 20, 64).

F6.

As F5 but to northwest of entrance. Not such a clear grouping as F5.

(387, 388, 389, 422, 493, 492, 495, 505, 506, 507, 499, 510, 349, 346, 419, 420, 392, 396, 393, 391. Possibly also 504, 384 and some smaller stakes to south).

F7.

Row of stake points between floor F17 and inner entrance.

Possibly partition supports for hurdling partition.

(311, 431, 361, 399, 400, 401, 402, 405. Possibly 392, 420 and others in F6 should be assigned to F7).

F8.

Walkway support. Possibly supporting radial timber on which smaller longitudinals lay to give actual walking surface.

As F9 - 13. (30, 33, 65. Poss 3).

F9.

As F8 and F10 - 13. (107, 125).

F10.

As F8 and F9 and F11 - 13. But more substantial timbers may represent more structurally significant function as part of entrance uprights and junction of causeway to entrance.

103 C14 dated 595+55bc.

(103,108,120).

F11.

As F8 - 10 and 12, 13. 3 substantial uprights 453 - 455 may be of significance to the end of the causeway as well as supporting radial walkway timbers. See also 458. There are some large timbers on the loch bed here which may, in some cases, be fallen uprights.

(453, 454, 455, 467, 469, 481).

F12.

As F8 - 13. (444, 445(601), 501, 502).

F13.

As F8 - 12. 458 is substantial and may have a causeway function also. (458, next, +1, 470, 471, 472).

F14.

Represented by 3 uprights and at least 5 thin longitudinal timbers. Possible walkway support timbers or remains of other eroded feature.

(ups 104, 105, 110. longs 149, 127, 106, 148, 126).

F15.

Small area of hurdling represented by 2 fallen stakes, one pointed, and a number of thin laterals. Underlies oak 93. (stakes 142, 143).

F16.

Jumble of large oak structural timbers projecting from organic matrix and stones prior to excavation. In this position they they appear to represent fallen remains of an entrance structure. A notch, of unknown function and badly eroded, was cut into the heartwood of 93. Some timbers to the northwest may also be part of this structure eg 473, but even tentative reconstruction is not yet, and may never be, possible. Erosion of upper ends of these timbers means that no articulated joints were found though the single end of 473 seems to have the remains of a stopped mortice and the other three ends are cut. The ends of 6 and 16 may be eroded tenons or may be eroded by resting on crutches of eg 141 or 473.
(93(369), 370, 372, 6, 4?, 17, 16, 141. Possibly 473).

F17.

Interior floor timbers. 3 layers of parallel, medium-sized tree trunks running southeast - northwest to the southwest of the mass of outer structural piles and delimited along the northeast edge by F7. They are up to 4 m long and the top layer was partially eroded on the upper surface. All were roundwood and there was no evidence of cutting or splitting They appear to have ended in the southeast before the edge of the

excavated area. They appear to have been eroded away at the southwest edge within the excavated area and appear fragmented or discontinued in the west, though they may penetrate the section near control point Q.
(numerous)

F18.

A number of sloping uprights, one substantial, are associated with an array of smaller branches projecting from south section in southwest corner of trench B. The function of the group is not clear. It may be part of F5 or part of another feature outside the excavated area. The smaller branches seem too thick to be hurdling and may have been laid down as flooring or packing. They are at a different alignment to F17 being more nnw - sse. They may be the sort of branches laid across the radials as a walkway surface. However, they may represent a small fence between the two large uprights of F5 and F18 ie 2 and 77, to contain stock or as weatherproofing.
(2, 79, 212 are sloping uprights. Many small longs.).

F19.

A group of sloping uprights on east of inner entrance. Possibly associated with F5 or F14. Function unknown.
(ups 74, 25, 91, 99. longs 131, 631).

F20.

Putative hearth. Edge projecting from southwest corner of sections in Area D. Hearths on crannogs, according to previous

excavations, are usually near the centre of the site and are often associated with `log pavements' of a relatively regular nature. (See Buston and Lochlee etc.). Therefore, a position to the southwest of the excavated area at Oakbank would seem reasonable.

The floor timbers do not extend into this corner and a number of substantial stones of a flattish nature suggest the edge of the hearth area. This is supported by burnt branches and lumps of charcoal in this corner, though these are found elsewhere on the site as well. Some of the stones are red, possibly from heating, and others are broken and degraded also as if heated. No positive proof has yet been found to establish this area as the edge of the hearth and clarification must await further excavation. An array of branches higher in this corner suggests that a structure existed above the level of the hearth at a later period. This structure may have been contemporary with the upper floor layers in D but it is not clearly associated and another hearth would have to be expected to serve the upper floor if this were the case.

F21.

The floor timbers F17 did not continue to the south section of trench D. There was relatively well-defined demarcation between F17 and a continuation down of large boulders like those in the upper layer of the site except that the lower boulders were embedded in white, silty material. Possibly this material was degraded clay or had been deliberately laid down to prevent burning of the lower timbers, (see below), which

underlie this area at a lower level, due to proximity to the putative hearth F20. In fact, F21 may be an extension of F20 though there was no evidence for the large, flattish stones seen in F20. F21 may be F20 tailing off. There are no stakes between F17 and F21 to suggest an upright solid partition.

F22.

Gangway substructure underlying large oaks of F16. A range of at least 6 radial timbers are evenly spaced in the area south of control point Y. The precise number of elements in this feature and their extent to northwest and southeast is not yet clear as the feature has not yet been fully excavated. As with all timbers exposed so far the radial beams were not articulated at the ends towards the inner area of the site. The ends were broken and there are no uprights yet discovered in the projected line of the ends. How they were supported at their inner extremities is not yet clear.

F23.

An area of large stones and boulders lay directly northeast of the row of partition stakes F7 and southwest of F22 radials. There was no apparent order or pattern in their layout and there was no suggestion that they presented either a wall or floor levelling.

F24.

Underlying F17 and F23 - the area of large stones and floor

timbers - a layer of thinner branches. This is the most extensive single layer so far exposed. It is not clear whether it represents a foundation layer for the upper floor F17 and the stones F23, or an earlier floor level. Finds from this layer were mainly clean, cut wood-chips in the proximity of the partition stake points F7 which at this level are loose and shallow as if they had been driven in at a higher level, but cut to a point at this lower level. Possibly they were consolidated by the upper large timbers and boulders after being set in position.

Clean bark and uneroded cut pole ends at the level of F24 suggest that this layer was covered over relatively quickly. Although the upper timbers of F17 were embedded in a layer of organic material there was not an obvious layer of this material between the upper, F17, and lower, F24, floor timbers. This would tend to suggest that these features are roughly contemporary. Finds from an area of timbers projecting from the base of the crannog mound on the west side suggest that there may be a lower floor level, beneath F24, although it may be the same layer distorted downward with the weight of boulders overlying it. Also, if F24 is the lowest floor then below it should be only brushwood, branches and packing forming a foundation to support F24 and upper layers. According to the section YQ, this is not the case and lower floors may be expected below F24. This supposition is supported by the results of pollen analysis. (see App. E).

F25.

Alignment of longitudinal timbers in northwest corner of area D with cut ends. Different orientation than F24. E - W.

Appendix C.

The first part of Appendix C is a report by A. Crone on timbers sampled from Oakbank Crannog. Most were of general context but forty alder piles surrounding the extension on the west side of the main crannog mound (fig. 15) were also sampled and are included in the report. A bar chart following Crone's report breaks down by species the timber samples identified by her and those reported in communications from T. Skinner of the National Museum of Antiquities which make up the final part of the appendix.

OAKBANK CRANNOG: PRELIMINARY REPORT ON THE WOOD

The wood from Oakbank Crannog has now been identified and is listed below. This list does not include the Extension material which is dealt with sepearately.

TOTAL:	232 pieces	
SPECIES	NO.	%
Alder	I2I	52
Oak	56	24
Hazel	37	I6
Pomoideae	I0	4.3
Birch	3	I.2
Willow	I	.43
Ash	I	.43
Elm	I	.43
Non-ID	2	.86

All the alder has now been examined. The stems vary in age from 6 to 59 years and in daimeter from 4.5 to I9cm. Alder is notorious for partial and missing growth rings so, in order to check for such occurrences, 3 radii on each stem were measured. A mean master curve was then produced for each stem. In almost 50% of the stems a partial ring on at least one radius was deteded. Within-tree matching has been successful in most cases although in a few cases the variation around the stem has been so great that no matching was possible. I have not yet begun matching procedures between different stems.

The Extension

All the information relating to the Extension is summarised on the computer printout. The stems vary in age from I8 to 60 years with an average of 28 years. They vary in diameter from I2 to 27cm with an average of I6cm. Of the 40 samples collected, 38 were of alder and only 2 were of willow.

Again, 3 radii per stem were measured and amean master constructed before cross-matching began. Out of 40 samples only one (XI3) could not be internally matched and one samples (XI4) had only one measurable radius.

The preliminary results of my attempts at cross-matching the stems by visual meansare not encouraging. Each stem will match with only 3 or 4

other stems and the matches are often notvisually very satisfactory. One of the problems, of course, is the relative shortness of the tree-ring series. Statistical tests, which I have not yet employed, will quantify the quality of the matches obtained visually. However, whereI do have acceptable matches they are tending to suggest contemporaneity (not unexpected!).

One of the reasons for the lack of matching may be suggested by the scatter diagram on the computer printout. This pbts age against diameter and indicates that there is very little relationship between the two. In otherwords the growth rate is highly variable, probably reflecting growth conditions in different localities.

Comparison with the Somerset Levels

The alder from the Somerset Levels is generally much smaller than the Oakbank material. It has usually been sampled from brushwood bundles, as at Tinney's Ground (Morgan 1978, 82-85; 1980, 69-72) and is between 3-22 year in age and 0.9 to 5.0cm in diameter. Morgan has detected peaks at 5,7 and 8 years in this materialwhich she takes to indicate coppicing.

Where alder of sufficient size for cross-matching has been examined Morgan has bean fairly successful. At the Baker site (1980, 24-28) 15 stems out of a sample of 67 stems were suitable and produced a mean curve of 59 years. At the Abbotts Way (1980, 50-51) 6 planks produced a mean curve of 66 years while at Meare Village West (1981, 36-37) 2 planks provided amean curve of 72 years.

At the Baker site Morgan tried to match the alder curves against other species. There was no correspondence with ash or oak but alder did match with the hazel. In this instance it is worth noting that, in the Extension the 2 willow samples (X7 and X8) have successfully matched with other alder samples.

Conclusions

The alder from Oakbank is certainly producing ring-patterns of sufficient length and sensitivity for cross-matching and my early attempts at visual matching may well be refined by computing aids.

I had hoped to be able to indicate the season of cutting. In alder this must be based on ring width as there is no distinction between early-and late-wood and, as the the ring-width waries considerably around the circumference of the tree, it is almost impossible to say whether it is spring or winter cut. On most of the Extension wood the outer surface is not complete due to erosion on the surface facing the current.

There seems to be little evidence for woodland management as yet. The Extension wood displays a fairly spread distribution of ages with no peaks (see histogram on computer printout) and this also seems to be the case with the alder from the main body of the crannog.

I have obviously concentrated on the alder because it comprises the bulk of the wood sampled so far. It is also larger in diameter than the remainder of the wood. The oak varies in diameter from 2.5 to 14 cm while the hazel varies from 3 to 10cm. It is unlikely that these will produce suffieiently long ring patterns for cross-matching.

9.6.84

```
--HIST  C4

C4  DIAMETER

MIDDLE OF       NUMBER OF
INTERVAL        OBSERVATIONS
     12               5       *****
     14              11       ***********
     16              10       *********x*
     18               7       *******
     20               3       ***
     22               1       *
     24               1       *
     26               1       *
     28               1       *

MEAN C4
AVERAGE =       16.1620
-- STAN C4
STD.DEV.         3.5453
```

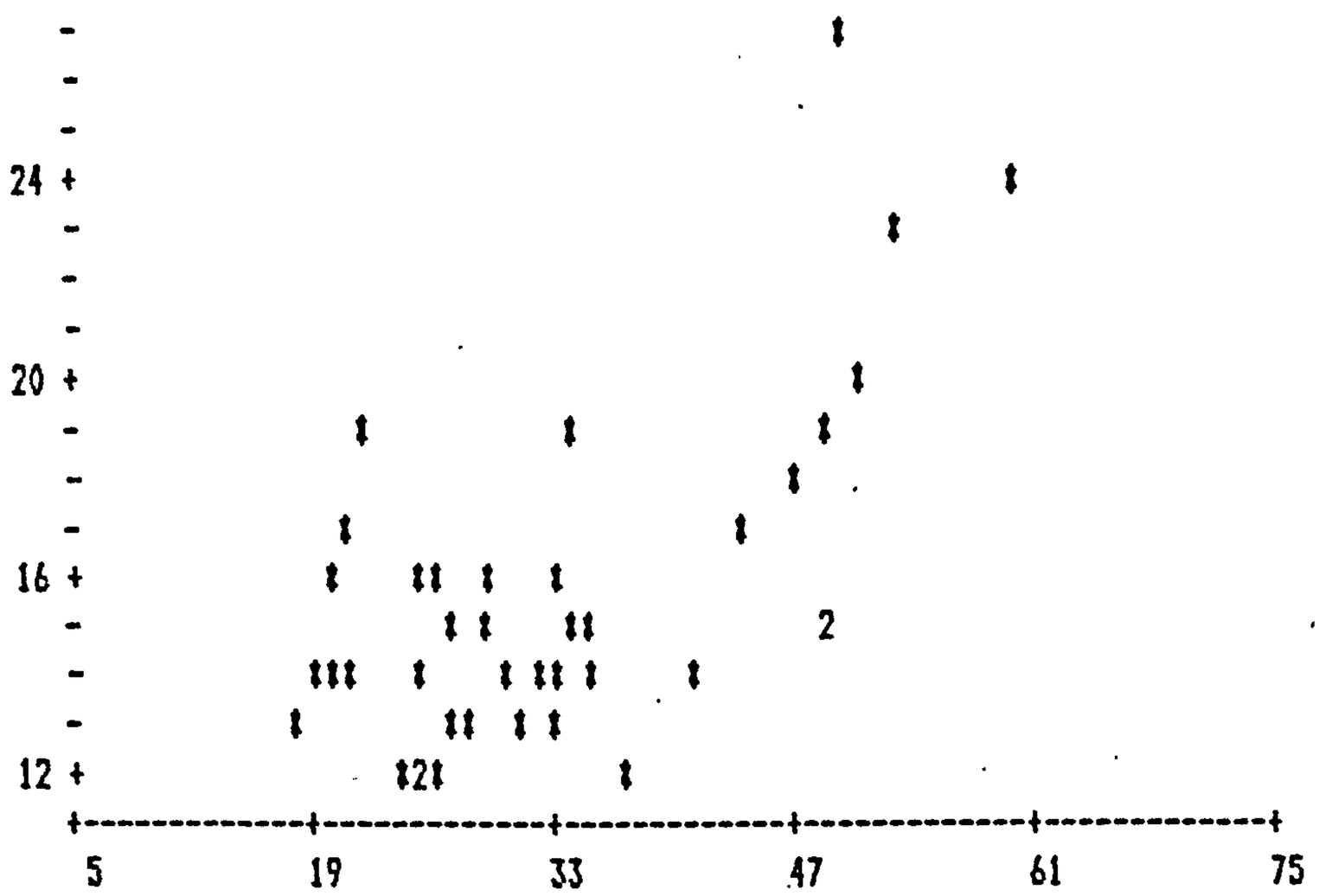
```
-- HIST  C6

C6  AGE

MIDDLE OF       NUMBER OF
INTERVAL        OBSERVATIONS
     10               5       *****
     15               4       ****
     20               6       ******
     25               7       *******
     30               4       ****
     35               5       *****
     40               1       *
     45               2       **
     50               5       *****
     55               0
     60               1       *

MEAN C4
AVERAGE =       28.8000
-- STAN C4
STD.DEV.         13.271
```

PLOT C4 C6



Alder	196	X2
Hazel	69	
Oak	63	
Pine	12	
Rosacae	14	
Birch	4	
Elm	5	
Willow	2	
Ash	1	
Ivy	1	
Rowan	3	

LOCH TAY WET WOOD SPECIES IDENTIFICATIONS

Find No.	Lab.No.	Object Description	Species
1	5731	Wooden whistle	Rosa sp.*1
61	5732	Basketry?	Corylus avellana
27	5783	Wooden peg in 3 pieces	Corylus avellana
71	5734	Wooden peg	Corylus avellana
None	5735	Four wooden pegs	Corylus avellana
60	5736	Wooden peg and hazelnut	Corylus avellana
21	5737	Basketry?	Hedera helix
None	5758	Shaped timber	Quercus
66	5759	Timber	Alnus glutinosa
19	5760	Notched peg	Corylus avellana
None	5761	Timber	Alnus glutinosa
6	5762	Fragment of wooden bucket	Rosaceae:*2
8	5763	Pointed stake	Alnus glutinosa
41	5764	Pointed stick	Corylus avellana
38	5765	Pointed stakes	Corylus avellana
12	5766	Taper? charred wood	Pinus sylvestris
42	5767	Worked wood	Alnus glutinosa
58	5768	Stake	Corylus avellana
59	5769	Stake	Alnus glabra
18	5770	Notched stick	Corylus avellana
84	5771	Worked points	Corylus avellana
A30		Timber	Alnus glutinosa
A76		Timber	Sorbus aucuparia
113 or)			
173 or)		Timber	Corylus avellana
193)			
117		Timber	Alnus glutinosa
150		Timber	Sorbus aucuparia
160		Timber	Alnus glutinosa
200		Timber	Alnus glutinosa
201		Timber	Alnus glutinosa
none	5757	Adze/axe chips	See next sheet.

Axe/adze chips: these were arbitrarily divided into two groups: larger chips were kept separate after identification.
Large chips (over 2 inches long) Small chips (less than 2 inches)

Species	No. of large chips	No. of small
Alnus glutinosa	25	4
Corylus avellana	5	4
Ulmus procera	1	
Ulmus glabra	1	
Sorbus ancuparia	1	
Sambucus nigra	1	
Pinus sylvestris	1	
Rosaceae	1 *3	1 *4

Notes: *1. The wooden whistle (LN5731; Find No. 1). Because of its delicacy and shape only one section could be unobtrusively taken. This showed very large rays (up to 60 cells high) with sheath cells and also some smaller (1-3 seriate) rays. This suggest the species Dogrose (Rosa) or Prunus Spinosa.

Notes (Continued)

*2. LN5762, Find No.6. Fragment of wooden bucket. The only places available for unobtrusive sectioning of this piece were heavily infested with fungal hyphae, making identification uncertain. The wood is diffuse porous with solitary pores, uni and biseriate rays, and as far as can be seen, only simple perforation plates. The wood itself is reddish in colour. My identification is that it is one of the Rosaceae, probably Pyrus or Malus.

*3. LN5757/33. An axe/adze chip. The anatomy is very similar to LN5762. Again identified as Rosaceae family, species uncertain.

*4. LN5757/f. An axe/adze chip. SImilar to LB5757/33 and LN5762. Rosaceae, probably Pyrus or Malus.

Quercus Sp.	Oak
Ulmus glabra -	Wych elm
Ulmus procera -	field elm
Sorbus aucuparia -	rowan
Alnus glutinosa -	alder
Corylus avellana -	hazel
Pinus Sylvestris -	Scots pine
Hedera helix	ivy
Rosa Sp. -	dogrose
Pyris	pear
Malus	Apple

Betula sp.	birch	It is not possible to distinguish between the various species of birch on anatomical grounds.
Salix sp.	willow	It is not possible to distinguish between the various species of willow on anatomical grounds.

Identifications were based on:

(1) Schweingruber, F.H. "Microscopic wood anatomy" 1978 Swiss Federal Institute of Forestry Research CH-8903 Birmensdorf.

(2) Brazier, J.D. and Franklin, G.L. "Identification of Hardwoods" Department of Scientific and Industrial Research, HMSO, 1961.

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Loch Tay Wet Wood Identifications

The following pieces have been identified prior to conservation to assist in the formulation of suitable treatments, and for the usual archaeological reasons.

Acc.No./Find No.*	Lab. No.	Object	Species
100	6936	wood chip	Alnus sp.
138	6934	wood point	Corylus avellana
142	6919	wood handle	Corylus avellana
153	6924	cut wood; handle?	Corylus avellana
158	6932	cut wood 1) chip	Quercus robur
		2) twig	Corylus avellana
160	6931	wood point	Alnus/Corylus**
163	6920	charred wood	Alnus sp.
165	6926	burnt taper	Pinus sylvestris
166	6921	burnt taper	Pinus sylvestris
168	6868	burnt tapers 1)	Pinus sylvestris
		2)	Pinus sylvestris
169	6839	cut wood	Quercus robur
173	6930	cut wood	Alnus sp.
174	6869	cut wood	Quercus robur
176	6861	burnt point	Alnus sp.
178	6918	burnt taper	Pinus sylvestris
174	6929	burnt taper	Pinus sylvestris
186	6874	worn cut point	Alnus sp.
190	6897	piece of loom?	Alnus sp.
202	6863	cut wood point	Alnus/Corylus**
209	6854	burnt cut wood	Alnus sp.
212	6896	basket work?	Alnus sp.
215	6865	burnt taper	Pinus sylvestris
217	6864	double point	Quercus robur
218	6862	cut point	Corylus avellana
220	6866	burnt tapers 1)	Pinus sylvestris
		2)	Alnus sp.
230	6867	cut wood	Alnus sp.
449	- 6853	stake tip	Alnus sp.
450	- 6849	stake tip	Alnus sp.
485	- 6845	stake tip	Alnus sp.
486	- 7202	stake tip	Alnus sp.
486A	- 6818	stake tip	Alnus sp.
498	- 6912	stake tip	Alnus sp.
505	- 6843	stake tip	Alnus sp.
611	- 6841	stake tip	Alnus sp.
701	6823	stake tip	Alnus sp.
703	6830	stake tip	Corylus avellana
705	6852	stake tip	Alnus sp.
709	6895	basket work?	Alnus sp.
716	6892	stake tip	Alnus sp.
718	6819	small causeway pile	Quercus robur
719	6834	stake tip	Alnus sp.
721	6835	stake tip	Alnus sp.
722	6838	stake tip	Alnus sp.

Acc.No./Find No.*	Lab No.	Object	Species
726	6913	Unidentified object	Alnus sp.
727	6898	twisted wood-rop?	Betula sp.
733	6894	burnt tapers 1)	Pinus sylvestris
		2)	Pinus sulvestris
740	6910	charred wood	Corylus avellana
745	6848	worked beam?	Alnus sp.
746	6851	stake tip	Alnus sp.
748	6917	basket work?	Corylus avellana
749	6876	cut stick	Corylus avellana
750	6817	large causeway pile	Ulmus procera

(The above are undergoing treatment with polyethylene glycol)

170	6860	utensil/spoon?	Alnus sp.
181	6888	utensil/spoon?	Alnus sp.
201	6870	mortice joint?	Ulmus procera
725	6837	yoke like object	Quercus robur
742	6915	canoe paddle	Alnus sp.
743	6914	round platter?	Alnus sp.
744	6916	coarse dish?	Alnus sp.

(The above are undergoing acetone/rosin treatment, as the objects require reconstruction.)

736	6904	charcoal fragment	Salix sp.
738	6902	charcoal fragment	Alnus sp.

(These have been successfully air dried.)

* Some uncertainty exists over which number is which in the original documentation.

** It was not possible to discriminate between these species without sampling the objects in a relatively destructive way.

Appendix D.

A REPORT ON THE ANIMAL REMAINS - Catherine Smith

(Nicholas Dixon - crannog bone)

The species represented in the bone samples provided for examination were cattle, sheep/goat, and pig. Fragments which were obviously from large mammals, probably cattle, but which were not identified as to particular bone, were designated as large ungulate.

All of the bones in the sample had apparently been subjected to great heat, resulting in the calcination of most of the specimens. Survival rates of recognisable bones other than teeth, small dense elements such as tarsals, sesamoids and phalanges, which can withstand mechanical damage more readily than the spongier long bones, was low. The majority of the bones had disintegrated into very small fragments. None of the bones were measurable, because of fragmentation or shrinkage caused by heat.

Below are shown the number of bone fragments identified, and numbers of teeth, which are estimated by counting and attributing internal pillars and enamel lusks.

	No of bone fragments identified (excluding teeth)	Estimated no of teeth
cattle	10	40
sheep/goat	3	5
pig	1	3
large ungulate	14	-

2/ (crannog bones)

The only evidence as to the age of the animals came from single loose teeth, as follows:

	Tooth (all mandibular)	Wear	Age inference
cattle	1 dm_3	unworn	very young or foetal
	1 M_3	III pillar unworn	<5 yrs
		III pillar in wear	>5 yrs
~~sheep/goat~~ ✓	1 M_3	III pillar unworn	<3 yrs
pig	1 M_3	in wear	>3 yrs

Number	Species	Bone
OB80 18/9 Area B General (20)	cattle	teeth: 1 internal pillar from molar
		1 enamel frag
	SHEEP/GOAT PIG	1 R. OS MALLEOLARE, CALCINED
	~~sheep/goat~~	tooth 1 lower M_3, in wear
		1 calcined 2nd phalange
	unidentified	28 calcined bone chips
OB 80 Site B General (45)	cattle	teeth: 1 internal pillar from molar
		1 piece enamel from molar
		5 pieces " " premolar (lower)
		1 enamel shell of incisor
		2 calcined pieces from prox end of L/R radius
		2 " " " dist end of 1st phalange
	large ungulate	3 calcined long bone frags
	unidentified	~170 small calcined bone chips
OB 80 14/9 Site B Layer 4 (9)		~15 enamel frags from molar(s)
	cattle	

3/ (crannog bones)

OB 80 14/9 Site B Layer 4 (50)	prob cattle	numerous very small enamel frags
	unidentified	~10 small calcined chips
OB 80 13/9 Site B Layer 4 (53)	unidentified	~100 calcined chips
OB 80 13/9 Site B Layer 4a (3)	?cattle	teeth: 1 internal pillar from molar 2 enamel frags
	unidentified	3 calcined chips
OB 80 17/9 Site B Layer 4a (5)	unidentified	approx 40 small calcined bone chips and numerous tiny chips (and 1 pebble)
OB 80 17/9 Site B Layer 4b (14)	sheep/goat	teeth: lower M_3; III pillar unworn " M_1 or M_2; in wear " PM; in wear 6 small enamel frags
OB 80 17/9 Site B Layer 4b (16)	cattle	teeth: remains of at least 3 teeth including enamel shell (part) of lower M 13 enamel frags from molars 6 internal pillars (bag labelled "teeth - jawbone", but no trace of mandible - perhaps disintegrated?)
	sheep/goat	small calcined frag from prox end of 2nd phalange
	unidentified	8 burnt or calcined bone chips
OB 80 19/9 Site B Layer 4c (23)	cattle	teeth: 3 pieces molar enamel and numerous small pieces enamel

4/ (crannog bones)

OB 80 19/9 Site B Layer 4c	pig	tooth: 1 upper M_3; in wear
(25)	unidentified	4 calcined frags
OB 80 25/9 Site B Layer 4c		
(81)	cattle	tooth: 1 upper M; in wear
OB 80 21/9 Site B Layer 4c	sheep/goat	dist end of L‡R ulna (calcined) (L/R)
(47)	unidentified	8 calcined bone chips
OB 80 23/9 Site B Layer 4b-c	cattle	tooth: enamel frag from ?incisor
(70)	unidentified	~45 calcined bone chips
OB 82 19/7 Area B	cattle	remains of at least 3 teeth including: shell of upper molar upper molar half of enamel shell of upper molar 2 internal pillars (molar) enamel frag
OB 82 19/9 Site B Layer ?- (24)	cattle	tooth: 2 enamel frags from M
OB 82 17/7 Area B Layer 4e	cattle	dist end of very eroded metacarpal
BC 78 12/4/18 199	large ungulate	?scapula frag, or ?rib distorted by weathering 6 bone frags, prob part of above
Find (14)	cattle	teeth: 2 internal pillars from molar 2 enamel frags

5/ (crannog bone)

5773	cattle	tooth: ~15 small enamel frags
	unidentified	7 calcined bone chips
5775	cattle	remains of at least 5 teeth including:
		lower M_1 or M_2; in wear
		enamel shell of lower M_1 or M_2
		enamel frag from probable lower M
		4 internal pillars
		lower premolar; unworn
		lower premolar; just in wear
		~20 enamel frags
	unidentified	4 calcined bone chips
5780	cattle	teeth: 1 enamel shell of lower M
		4 internal pillars
5792	cattle	tooth: 1 upper molar in 4 frags ie enamel shell, 2 internal pillars and 1 accessory pillar
Box labelled "photog teeth 17.9.82"	cattle	teeth: lower M_3; III pillar in wear
		lower premolar; in wear
		" " ; in wear
	sheep/goat	tooth: lower M_3; III pillar broken off
No label	cattle	tooth: calcined ~~shell~~ SKULL frag, prob from frontal region
		1 lower dm_3; unworn
	unidentified	4 calcined or burnt chips

No label	sheep/goat	teeth: lower M_1 or M_2; in wear
		part of lower M_3; III pillar unworn
		internal pillar from above M_3
		2 pieces enamel from above M_3
	cattle/sheep/goat	tooth: enamel frag from molar
	large ungulate	calcined long bone frag
	unidentified	~15 calcined bone chips
No label	cattle	teeth: remains of at least 3 molars including:
		upper molar; unworn
		enamel shell of upper M
		4 internal pillars
		4 enamel frags
	unidentified	2 calcined bone chips
No label	cattle	teeth: prob III pillar of lower M_3
		1 enamel frag
		possible dist end of 1st phalange (calcined)
	unidentified	~50 calcined bone chips
No label	cattle	teeth: 2 internal pillars from M
	sheep/goat	frag of upper M
No label	cattle	teeth: 2 upper M; in wear
	pig	tooth: 1 M_1 or M_2; in wear
No label	cattle	teeth: remains of at least 2 upper molars incl:
		3 enamel frags
		4 internal pillars

7/ (crannog bones)

No label	cattle	sesamoid (calcined) in 2 pieces (associated with metapodials)
	unidentified	6 calcined or burnt fragments
No label	?cattle	frag of calcined mandible: oral, no teeth
	large ungulate	3 calcined bone frags, possibly from dist humerus or femur (?)

NB ~ = approximately

M = molar

Appendix E.

In 1982, a core was taken at Oakbank Crannog which penetrated the main organic deposit from top to bottom and into the loch bed silts. The core was examined by Dr. R. Scaife of the Institute of Archaeology, London and his report is contained in Appendix E.

POLLEN ANALYTICAL METHODOLOGY

Samples of peat/sediment for pollen analysis were taken from the core sample at 4 cm intervals. Standard techniques were used to extract and concentrate the contained microfossil pollen and spores. Samples of 1-2 ml were subjected to NaOH defloculation, digestion of silica using HF and Erdtman's acetolysis for removal of cellulose. Pollen was stained with safranin and mounted in glycerol jelly. Where possible, a sum of 300-400 pollen grains was counted using plain and phase contrast microscopy. The results of this analysis are presented in diagram form with all pollen taxa being calculated as a percentage of total pollen. Spores of Pteridophytes were counted outside of the basic pollen sum and have been calculated and represented as a percentage of total pollen (%= TP+ spores).

The basal grey sands of Zone 1 (78-90 cm) although of highly inorganic character, contained both pollen and spores. As might be expected, the pollen was present in lower frequencies than in subsequent more organic levels. The dominant taxa found were Alnus, and Corylus type in the arboreal category, and Graminaea in the herbs. The Zone is, however, dominated by spores of Pteridium aquilinum and Dryopteris type. The latter are present in exceptionally high frequencies. Pollen and spore preservation in these levels was good and differential pollen destruction is not the likely cause of such a high representaion of spores. Furthermore, evidence of many clusters of spores still enclosed in sori was noted.

Those pollen of arboreal taxa present undoubtedly represent the vegetation marginal to the loch; that is, within the sphere of the pollen catchment and/or river or stream input into the loch (introducing secondary pollen to the sediments). From this is inferred a vegetation dominated by Alnus with some Quercus and Ulmus. It is likely that Alnus was present in the ecologically favourable areas fringing the loch although comparison with present day stands may

indicate a more widespread occurrence on even relatively steep valley sides where its moisture requirements are met by high levels of precipitation. Ulmus, Quercus and Corylus were undoubtedly present growing on drier soils. The extent of this woodland is difficult to ascertain because of the effects of the overrepresentation of Alnus in the pollen sum (Janssen 19) and the possibility of differential filtration through the fringing alder growth (Tauber 1967). Corylus is shown in this and throughout subsequent levels as being an important woodland or shrub component growing on surrounding drier soils. The vegetation of areas adjacent to the loch was one of Quercus, Ulmus and Corylus woodland. Alnus was especially prevalent fringing the loch. The high frequencies of Dryopteris spores and to a lesser extent Pteridium would indicate that this pteridophyte material may have become dominant in one of a number of ways:

a) incorporated as a bonding material prior to crannog construction.
b) the basal sand was dumped material from the adjacent foreshore. These areas may have had stands of Pteridophytes growing on them.
c) that a greater input of spores may have been inwashed during periods of high fluvial discharge into the loch from the surrounding fluvial catchment(Peck 1973). If this were the case, higher frequencies of pollen might have been expected.

Floor level 1 (58-78 cm) comprised small boulders to 15 cm, resting on the basal sand of pollen /stratigraphical Zone 1. This was overlain by coarse sand and gravel material all of which were intercalated with deposits of organic/humic material. Palynologically, this level is clearly defined. High pollen percentages of Alnus and Corylus type (which include Myrica) decline sharply in response to a marked increase in a number of herbaceous taxa. This decline does not necessarily and is not likely to reflect an episode of deforestation. It is more likely to be a statistical response to the sharply increasing values of a number of herb taxa (NB 1). These latter are notably Ranunculus type, Plantago lanceolata, Artemisia, Taraxacum type (Liguliflorae), Graminaea and cereal pollen with to a lesser extent a much increased diverstiy of herbs. This diverstiy of herbs is maintained throughout subsequent zones. Predominant are those taxa

NB 1: An increase in any one taxon will cause a percentage decrease in others present within the same pollen sum

which are associated with anthropogenic activity of both pastoral and cereal cultivation. These herbs can also be divided into those types which occur in this zone and subsequently remain important and those which show dominantly high values only for this floor level zone. The latter are notably Ranunculus type, Artemisia, Taraxacum type and Pteridium aquilinum. Interpretative problems exist as to whether these taxa are of 'secondary origin' incorporated within the sand component and if so, which plant community they are representative of. Their strong correlation with the levels of the floor is suggestive of sand/gravel material taken from dryish areas of non wooded open and only partially stable areas along the shore of Loch Tay. Such a disturbed habitat could support these plants of ruderal/waste ground character. A similar representation of this community is seen from 45 cm in Zone III into floor 2 (22-30 cm) where Pteridium aquilinum pollen and macrofossil remains were abundant. Some of the remains of Pteridium leaves showed evidence of charring and it is possible that it was used for both floor covering and/or bonding and as dry timber material for fires. The use of bracken as animal feed has been suggested for prehistoric lowland England (Dimbleby and Evans 1974) and should also be considered as a likely cause for these abundant spore and macrofossil remains. It seems appropriate that younger bracken or its roots would have been more palatable and selectively grazed or collected rather than older, dried out plants gathered in autumn when spores would have been abundant.

The second group of taxa which are of substantial importance from these levels are of a strongly anthropogenic nature. These are characterised by Plantago lanceolata, cereal and other Graminaea forming the dominant group with lesser representation of Leguminosae (Trifolium type and Medicago type), Rumex and Scrophulariaceae. The majority of these types represent plant material of secondary derivation incorporated into the fabric of the floor (the organic component noted above) or pollen which has moved down into the coarse mineral floor; (from the immediate post floor construction phase of occupation). In Britain no direct analogy can be made with other crannogs from which pollen has been researched. Situations which may yield future data are those of Glastonbury and Meare 'Lake Villages' (A Caseldine) and Flag Fen, Cambridgeshire (Scaife awaiting analysis). Interpretation is therefore problematic. Because of the nature of the platform structure and its

widespread organic deposits resting upon and in the floors (Zones II and IV), the plants are of undoubtedly secondary anthropogenic derivation introduced onto the crannog. This accounts for the majority of pollen represented in the pollen zones. A lesser element of 'natural' deposition on to the crannog (as discussed for Zone 1 above) is represented in the arboreal taxa recorded. The closest analogy to such a situation which may help to explain such phenomena as the remarkably high cereal pollen content, are the analyses of pollen spectra from urban environments. Researches in recent years (Greig 1981, 1982, Krzywinski 1983, Hall et al. 1983, Scaife 1982, and Scaife in Macphail 1981) on medieval and later urban contexts are markedly similar in the fact that the majority of pollen present is directly representative of human activities. Analogously, high pollen values for cereals and associated weeds were noted in areas obviously not being cultivated. It is to these data that an explanation of the remarkably high cereal pollen frequencies (up to 50% TP at 62 cm) and of many other ruderals of Zones II to IV must be sought.

Robinson and Hubbard (1977) recognised that the pollen of cereal types may be trapped in the husks of the grain and subsequently transported elsewhere. This provides the key to the high frequencies of cereal pollen from cesspits and latrines (Greig 1981) and areas where ordure has been dumped (Scaife 1982, Scaife in Macphail 1981). In these cases pollen has become incorporated into spoil along with ruderals characteristically associated with arable ground. Much of the cereal pollen recorded here may have originated in this way from human or animal faeces. Liberation of the pollen trapped with the cereals has also been suggested as a result of corn processing (winnowing) in living areas. This process is frequent in the Near East (Hillman 1981) but also occurred within urban environments in Britain. Jones (1978) has illustrated this in the Isle of Wight with pollen evidence found in a medieval street situation (Scaife 1981, Tomalin and Scaife forthcoming). Possible explanations of those values found on the crannog may be summarised as follows:

i) 'on site' cereal processing resulting in pollen liberation and deposition on the occupation area.

ii) pollen may have become incorporated into human or animal faeces. Both have been found on the site and await pollen analysis.

iii) quantities of straw material (especially in Zone V) are evidence of floor coverings, animal feedstuffs or amorphous chaff, and so on, from animal dung.

One of more of the above factors could have resulted in the extraordinarily high quantities of cereal pollen which are not found in analyses of Scottish peat mire or lake sediments. Examination of the occupation material for plant macrofossil remains revealed few cereal caryopses. Accepting that some cereal pollen may have adhered to stem/straw material, the derivation of this pollen is likely to have resulted from points i and/or ii.

In addition to their mode of inclusion into these anthropogenic deposits the cereals illustrate an important arable subsistance section of the economy. This must have been practised on surrounding areas of greater soil fertility. It is hoped to carry out a 'normal' pollen analysis of Loch Tay sediments close to, but outside, the area of influence of the crannog. This would enable an examination of the way in which such cultivation is represented in the pollen record against a background of more regional pollen rain. The representation of cereal is strongest immediately overlying floor 1 with its high pollen values of 50%(TP) and it is the only taxon in the pollen recorded here which can be considered evidence of a direct food resource. Pollen taxonomy does not allow in many cases, identification to species or often generic level. Consequently, such pollen as those of Umbelliferae, which similarly occur to 10% (TP) immediately overlying floor 1, may be evidence of foodstuffs or plant utilization. Investigation of plant macrofossils can in this respect provide more useful data. Umbelliferae seeds (achenes) were not forthcoming from the preliminary macrofossil investigations carried out at these levels. This contrasts strongly with Chenopodium album seeds found in profusion (Stokes 1981, Scaife 1983). Chenopodium is anemophilous and provides pollen in high quantities. Consequently, it can be strongly represented in pollen spectra. Despite the high frequency of seeds present, relatively small pollen percentages are found (0-2% TP). This leads to the conclusion that Chenopodium album was one of a number of plants used as a food resource collected from elsewhere and transported to the site. Numerous Corylus nuts and a number of Prunus seeds were also recovered from the organic floor coverings. There is

a strong pollen representation of Corylus (separated from Myrica although some of this taxon may be included) is also seen. This is reasonably expected from this anemophilous shrub which produces copious quantities of pollen. Both were therefore available as food and, with Quercus and Alnus, as timber resources growing in areas surrounding the loch.

In addition to the arable agricultural component (above), there is a strongly pastoral element. This is discernable from the high values of Graminaea both in the living floor (Zone II) and in the occupation levels(Zone III), and may be associated with other herbs present - notably Plantago lanceolata. It is plausible that these are pollen elements introduced onto the site directly in animal feedstuffs or secondarily in animal excreta.

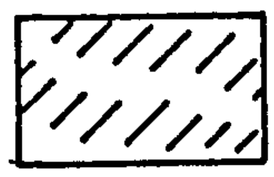
Zone IV (floor 2) and Zone V exhibit broadly similar phenomena to those described above (related largely to Zones II and III). Some minor differences do occur. The floor level (2) of Zone IV (22 cm to 30 cm) comprised coarse sand with a number of small boulders and an incorporated waste flake. This horizon contained the same high frequencies of Artemisia , cereals and Pteridium. The overlying organic material consisted largely of straw and inidentified monocotyledonous debirs. Pollen contained is indicative of both arable (cerealia) and pastoral character. The latter is more strongly represented than in pollen Zone III with Graminaea, Plantago lanceolata, Rumex and possibly Ranunculus type and Papilionaceae.

Throughout the period of occupation the natural regional vegetation shows a continuation of that noted in Zone I. The arboreal vegetatiom remained dominated by Corylus, Alnus with lesser quantities of Betula, Ulmus and Quercus in areas and on soils suited to their growth. Indication of other 'natural' herbaceous plant communities are present. Tall herbs communities may be represented by Trollius europaeus, Caltha type, Thalictrum, Lychnis type, Filipendula, cf Geum, Sanguisorba officinalis Scabiosa and Succisa. (Pollen determination according to Birks (1973) and by comparison with reference material) Some of these taxa are characteristic of damper/wet flush and fen type areas. It is interesting to note that plant communities typical of acid and poor soils are only

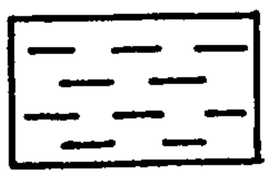
weakly represented. Heathland (Erica and Calluna) pollans are of little importance as are Sphagnum spores indicative of blanket or topogenous peat growth. This factor allied to the rich herb flora and the predominant evidence of cereal cropping being carried out infer that little soil deterioration had taken place by this date. Areas of pastoral and arable agriculture occurred within a region supporting woodland of Corylus, Quercus, Ulmus, a little Betula and Alnus.

Prunus endocarp.

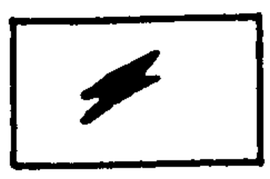
Wood.



Straw remains.

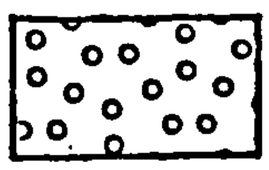


Organic/peat detritus.

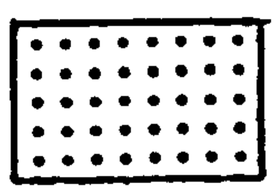


Flint waste flake.

Small boulders.



Coarse sand/gravels.



Sand.

Figure E2 Key to pollen diagram stratigraphy

LOCH TAY CRANNOG

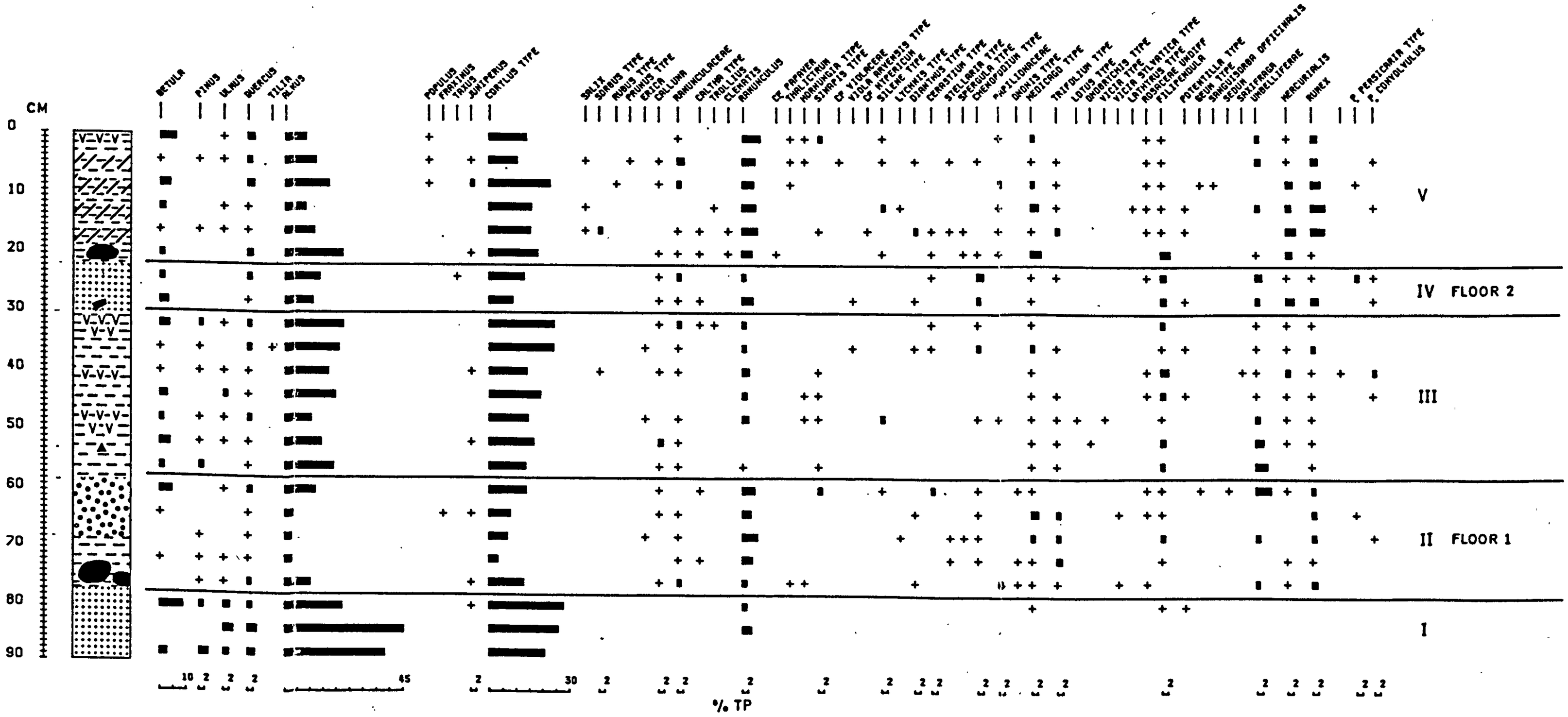
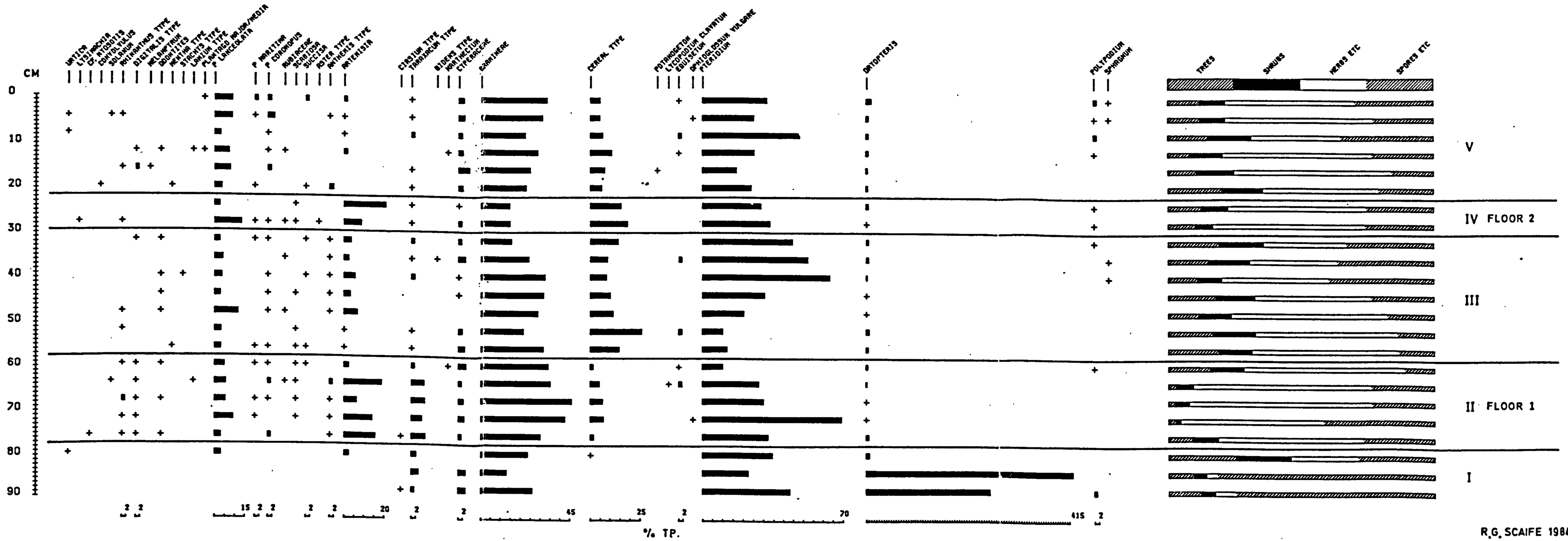


Fig. E1/2

LOCH TAY CRANNOG



R.G. SCAIFE 1984

Appendix F.

Appendix F is an extract from the final year dissertation of J. Stokes for a degree at the Institute of Archaeology, University of London in 1982 (Stokes 1982, unpublished). It includes the results of an examination for macro-plant remains by Stokes and contributions on pollen, phytoliths, insects and other aspects of the sample by herself and others.

2.2 Derivation of organic layers

It was suggested at first that the organic material might not be *in situ* in the crannog structure but may have been deposited by natural means after the crannog had been abandoned and submerged. Several facts however support the idea that the material was deposited during occupation.

(i) The organic layers were everywhere sealed by the layers 1, 2 and 3.

(ii) Underneath the stones the top organic layer was compacted and formed a flat "skin" which could almost be peeled off, so it did not appear to have sunk down through any gaps between the stones.

(iii) The material had evidently been very little decayed (as it would have been during a period of transport in the water before deposition for example) since when first exposed it was very light in colour, darkening within an hour or so of lifting, even when kept in loch water, - the first stage of decay? Whether this darkening was due to exposure to light or to oxygen or to both was not determined.

(iv) The large amount of finds within the organic layers in the small area excavated are not in keeping with a theory of a natural origin for these layers.

(v) Analysis of a sample taken from the loch bed some 200m along the shore showed that it contained a thin layer of organic material mixed with the silt.

This organic material was in a much more degraded and decayed state than that on the crannog, with fewer whole seeds and generally much smaller particles. This may result from transport in the water and implies that the very different material on the crannog is <u>in situ</u>.

The reason for the complete covering of stones on the crannog is not yet understood, but is important in understanding the origin of the organic layers. Such stones are a feature of most crannogs. They may be the collapsed remains of a stone structure built on the crannog, or may be part of the mound itself, though the organic layers and the amount of finds under the stone layers do not support this interpretation. The stones may represent an attempt to rebuild the crannog and there is evidence of reoccupation in the form of some upright posts lying with their bases in the organic layer, much higher than the other uprights.

That vast amounts of organic material can be accumulate naturally is demonstrated at Eadarloch (Ritchie,1942,13) referred to in the previous chapter. However this material lay beneath the crannog rather than within it and there are no sand-spits at Fearnan as there were in the Eadarloch to form eddies in which material could be deposited.

3. <u>The range of environmental evidence, its state of preservation and results</u>

Sample 4 (see fig (ii)) was analysed in the laboratory to show the range of evidence preserved. Sub-samples were taken for pollen and phytolith analyses; the remaining material was then given hydrogen peroxide treatment to

to deflocculate it. This was then passed through a nest of sieves of 2mm, 1mm and 500 micron size. The material from each sieve was kept separate since it was by then already partially sorted by the sieving process. Pieces of wood and charcoal were picked out by hand and then paraffin floatation was carried out followed by sorting under a low-power microscope to recover the seeds, insect remains, mosses and other macroscopic remains.

3.1 Wood

Only the nine pieces of wood which had been incorporated into the sample were identified. These ranged from less than 1.0cm in diameter to over 3.0cm. They were in a totally waterlogged and soft state but the structure was very well preserved. Once impregnated with a 50% solution of Carbowax 1500 it could easily be cut into sections with a scalpel and mounted in either glycerol jelly or styrolite for identification.

There was one piece of Pinus sylvestris (Scots Pine) which seemed to be a chip from wood-working rather than a twig. Of the remaining pieces, five were Corylus avellana (Hazel) and three were Alnus sp. (Alder). In comparison the artifactual wood identified by the National Museum of Scotland was all Alnus sp. Some of the larger timbers on the crannog were obviously Quercus sp. (Oak) and more taxa may be present.

3.2 Charcoal

Charcoal was abundant throughout the excavated area but only two pieces were incorporated in the sample. These were identified as Corylus avellana (Hazel) and Alnus sp. (Alder).

3.3 Seeds and fruits

The seeds and fruits were in a good condition, largely unbroken, and many still had hairs on their surfaces and at the apices. The following taxa were identified:

No.found				(See Key below)
10	CARYOPHYLLACEAE	Stellaria media (L) Vill.	Chickweed	E.D
15		sp		
99	CHENOPODIACEAE	Chenopodium album. L	Fat hen	E.D
1	COMPOSITAE	Artemisia vulgaris. L	Mugwort	D
11		Lapsana communis. L	Nipplewort	E.D
1		sp		
1	LINACEAE	Linum usitatissumum. L	Cultivated flax	E
4	POLYGONACEAE	Polygonum convolvulus.L	Black bindweed	D
15		Polygonum persicaria L	Redshanks	D
70		spp		
1	ROSACEAE	Rosa canina L	Dogrose	E
		Rubus fruticosus agg.	Blackberry	E
20		Rubus idaeus L	Raspberry	E
6	RANUNCULACEAE	Ranunculus sp (cf.R.Repens)	Buttercup	
1	UMBELLIFERAE	sp		
31	URTICACEAE	Urtica dioica L	Stinging nettle	E.D

Key

E - some part of plant edible.

D - species usually associated with disturbed land.

3.4 Insects

The insects from sample 4 were looked at by Dr. Ken Thomas. There were too few insect fragments to warrant identification since no ecological conclusions could have been drawn from so small a sample.

Preservation of the material was good with small, thinly sclerotized fly puparia (Dipteria) present and, in fact, dominating the assemblage. Elsewhere in the excavated area large concentrations of fly puparia were found and flies must have flourished in the organic layers before they were submerged. Other fragments preserved were wing cases (elytra), pronota, head and leg pieces. Identification of these to species level should be possible.

If larger samples of some 10-15 kg. of material are taken, the insects should provide a good source of information about the organic layer and the environment on and near the crannog. However, identification and interpretation of a large assemblage will need the co-operation of an archaeo-entomologist.

3.5 Pollen (Dr. Rob Scaife).

Pollen was concentrated from approximately 1 ml. of sample 4 using a minimum of chemical preparation. The material was boiled in 10% solium hydroxide to deflocculate it and to remove the humic colloids, it was then poured through a 150 micron sieve to remove the coarse organic debris, stained with aqueous safranin and mounted in glycerol jelly. A pollen sum of 300 grains was counted and 38 spores recorded (see Table 1), pollen was calculated as a percentage of total pollen, and spores as a percentage of total pollen plus spores.

25 pollen and 3 spore taxa were recorded. Of these the herbaceous types formed the dominant constituents being 79.5% of total pollen. Arboreal taxa constituted 12.7% TP; shrubs 7.8% TP and dwarf shrubs 0.7% formed the smallest groups.

TABLE I

	Pollen frequencies from Sample 4 - Oakbank Crannog	Frequency	% TP.	
Tree	Alnus	31	10.3	15
	Betula	3	1.0	
	Quercus	4	1.3	
Shrub	Corylus type	22	7.3	2.2
	Sorbus type	1	0.3	
Dwarf Shrub	Calluna	2	0.7	
Herbs	Artemisia	1	0.3	
	Chenopodium type	2	0.7	
	Cruciferae undifferentiated	1	0.3	
	Dianthus type	1	0.3	
	Filipendula	7	2.3	
	Ononis type	1	0.3	
	Papilionaceae undifferentiated	1	0.3	
	Plantago lanceolata	11	3.7	13
	Potentilla type	2	0.7	
	Ranunculaceae undifferentiated	2	0.7	
	Ranunculus type	17	5.7	10
	Rhinanthus type	3	1.0	
	Rosaceae undifferentiated	4	1.3	
	Stellaria type	1	0.3	
	Taraxacum	1	0.3	
	Umbelliferae	2	0.7	
	Cyperaceae	4	1.3	
	Gramineae	134	44.7	55
	Cereal type	38	12.7	8
			% TP. + spores	
Filicales	Dryopteris type	3	0.9	
	Polypodium	1	0.3	
	Pteridium	34	10.1	

The low arboreal pollen frequencies suggest either

(i) the pollen catchment had been cleared of trees by the time the organic layers were being laid down or

(ii) pollen from herbaceous material laid down on the crannog (possibly as flooring) is greatly in excess of pollen derived from locally or regionally growing vegetation, and its abundance is therefore exaggerated.

It is difficult to establish which reason is most important but the building of the crannog superstructure may account for local deforestation. It should be noted that the chip of Pinus sylvestris found in the sample (see above) may well have come from outside the pollen catchment area since no pine pollen was found although Pinus sylvestris is a good producer of pollen. The pollen catchment area is likely to represent the confines of the Loch Tay basin since it is surrounded by high mountains.

The high proportions of cereal pollen and associated ruderals may represent pollen input from these plants growing on land near the crannog or alternatively may be the result of crop processing. Grasses are likely to have been used extensively as floor covering or as animal fodder.

Pollen preservation (Birks, 1970,812). Preservation was good in general although a few broken or crumpled grains were noted. Alnus sp. was the only taxa which seemed to be in Birk's "degraded" category, that is with the sculptural and structural elements of the grain difficult to resolve under the microscope. No corroded grains were present.

The degradation of these alder grains is likely to have been because they were of an allochthonos native either being washed in from the valley sides or deposited on the site after having floated from upstream in the loch.

More complex preparation techniques could have been used on the sample including further concentration by acetolysis, and hydrofloric acid treatment to remove the small quantity of silica grains in the sample although these neither obscured the pollen nor hindered the analysis. In order to ascertain the true status of the Loch Tay forest during the period when the crannog was occupied, a series of lake or peat cores should be taken at some distance from the direct influence of human occupation. Further samples from the crannog itself may give more evidence on site use throughout occupation.

3.6 Phytoliths

In order to see whether there was any potential for the study of phytoliths on Oakbank Crannog, about 2 cm^3 of Sample 4 was ashed and a count of 100 phytoliths taken. The results shown on the table below are based on the terminology of Twiss, Suess and Smith, 1969.

Phytoliths count

Group I	Festucoid Class	
	1a Circular	3
	1c Elliptical	1
Group II	None found	-

Phytoliths count (cont)

Group III	Panicoid Class		
	3f	Dumbell, short shank, straight or concave ends	1
	3i	Regular, complex dumbell	2
	3J	Irregular, complex dumbell	1
Group IV	Elongate Class		
	4a	Elongate, smooth	29
	4b	Elongate, sinuous	28
	4c	Elongate, spiny	1
	4d	Elongate, spiny with pavement	34
		Total	100

Although phytoliths were abundant, they were mainly of the indistinctive Elongate Class rather than belonging to Groups I - III which are more characteristic of certain grasses. Phytoliths therefore can tell us little or nothing about the organic layers at Oakbank Crannog, where complete material is preserved as readily as any distinctive phytoliths from it.

3.7 Miscellaneous macroscopic remains.

As can be seen from plate IIIb, most of the sample is composed of fragments of bark, wood, stems and leaves with seeds and insects forming only a small proportion of the total material. The inorganic component is also very small. Of this miscellaneous macroscopic component, only the mosses and the pieces of fern were identified, though it may well be possible and useful to identify other types of material, for instance any cereal chaff that may be found.

Five moss samples were identified by Dr. Francis Rose of Kings College, London. Preservation was good and the samples were not fragmentary like many sub-fossil mosses. Two of the samples were of Hypnum cupressiforme type, probably H. mammillatum. The other three were Plagiothecium aurifolium, though one of these tended towards the P. laetum type (Smith,1978). All these mosses are found today in acid woodland such as exists in the Scottish highlands, growing around the base of tree-trunks. The mosses may either have been collected deliberately or may have been carried onto the site on pieces of bark or wood.

The fern leaves were identified as Pteridium aquilinum (bracken). Fairly large quantities were present on the site perhaps as a result of its use as flooring material.

4. The Potential of the material found.

4.1 Interpretation.

The macroscopic plant remains and, more specifically, the seeds, exemplify the potential of waterlogged material from underwater sites. Interpretation of macroscopic remains from archaeological sites is usually dependent, explicitly or otherwise, on a model explaining the mechanisms by which the material is preserved (Dennell, 1976,235). Although Dennell and others have suggested the ways in which seeds can be carbonised, these do not fit the situation at Oakbank Crannog where preservation is due to waterlogging within the polyphenol-rich organic layers.

The model in Fig.(v) represents some first ideas on the mechanisms at work on Oakbank Crannog and, although it is oversimplified and based on the assumptions discussed below, nevertheless reveals some of the major differences between waterlogged material and carbonised material. It may provide some guidelines for interpretation.

It is assumed that people lived on the crannog and/or kept animals on the site. Although this seems likely it has not yet been proved conclusively for this crannog. A second assumption is that the top part of the organic layers (from which sample 4 came) represents a floor. Analysis of samples further down within the organic layer and a greater understanding of the archaeology after further excavation, should test the latter assumption. The uppermost layers could instead represent part of the brushwood and rubbish

infill of the man-made island itself, or a layer produced after abandonment and overgrowth of the crannog (see below). The number of finds, the size of the timbers, the height within the mound of layer 4a, argue against the first alternative: the relative homogeneity of the organic layers as seen during excavation up to and including the samples layer, argues against the latter, but neither possibility is yet ruled out.

The results are treated as though the sample is representative of the top layers of the whole crannog. This is a doubtful assumption since the sample is only some 7 cm. in diameter whereas the crannog is over 14 m. The area excavated may be located in an area where activities differed greatly from those in other areas of the crannog. Cultivars, for example, may be far more common elsewhere on the site. This assumption does not greatly affect the model, but only those conclusions that may be based on it at this early stage.

We do not know whether submergence of the crannog caused its abandonment or whether submergence was due to lack of maintenance when it was no longer occupied. This has direct bearing on the state of waterlogging of the top layers of the crannog during occupation and consequently what type of material is preserved. Material may have been constantly laid down on the floors to keep them dry as the crannog sank, so building up a great depth of waterlogged flooring material and incorporated cultural and food debris. On the other hand the structures and other organic material may have partially

decayed before they were submerged some time after the last occupation. The effects of the water washing around the structure as the crannog sank are not understood and how much of the organic material, for instance, was eroded and deposited elsewhere. Organic material of similar composition but in a poorer state of preservation both in the loch bed and at the base of the crannog near the causeway, may result from such erosion or may be the remains of rubbish thrown over the edge of the crannog.

During excavation material which resembled excreta was found and although this has not yet been confirmed, nor has the type of animal it may represent been identified, animals and their dung have been included in the model as a way in which material could be preserved. When analysed it may yield definite data on which plants were being eaten by man and his domestic animals, and the activities taking place on the crannog. Excreta was found in comparable preserving conditions at Vindolanda (Seaward, 1976,23) and contained the eggs of ticks or mites.

4.2 Conclusions from preliminary work.

Of all the seeds recovered only one may be direct evidence of agriculture - a single specimen of Linum usitatissumum, which was grown for both fibre and oil but may possibly also have been a weed in corn fields. There is no evidence as yet on ancient field systems in the vicinity but future work could include a thorough survey of the land adjoining the crannog.

Most of the seeds are from weeds of disturbance, some of which may prove to have been eaten. The cause of this disturbance could have been the cutting down of trees in the immediate area of the crannog for structural use, for firewood and possibly also for charcoal to smelt iron ore. Although no Gramineae seeds were found, perhaps because they do not preserve well, Gramineae pollen was very abundant and this is in keeping with the theory of tree clearance, which would also have provided grazing for animals. The weeds of disturbance are also of the type that would have colonised the crannog after its abandonment.

4.3 Future work on Oakbank Crannog.

The samples which were taken from the area beneath the causeway and from the loch bed could be analysed to assess the state of preservation and to see what taxa were present, and could then be compared with the samples from the organic layer within the crannog itself. An alternative approach to understanding the processes at work as crannogs sink would be to use one of the reconstructed crannogs in Ireland for some experimental archaeology!

Further samples down through the organic layers could be taken to see whether there was any change in the economy or in the environment through time and to clarify understanding of the way in which the great depth of organic material had built up. When a larger area of the site is excavated, samples from different areas of the site, perhaps selected on a probabilistic basis, and within any recognizable structures, may give more evidence of the various activities on the site and where these were taking place. Animal byres,

human sleeping quarters and threshing areas, for instance, might be distinguishable by the seed, insect and other macroscopic remains.

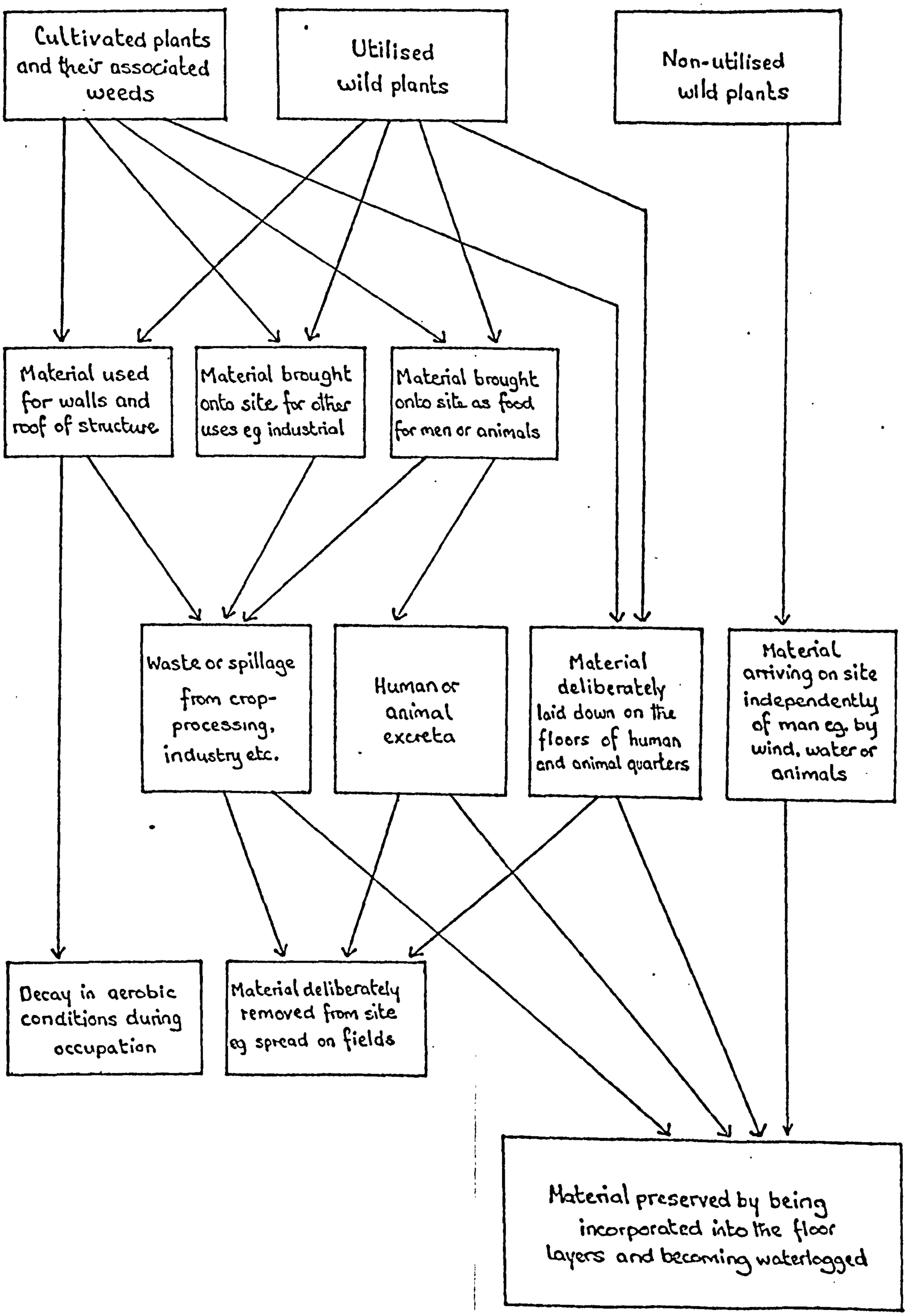


Fig (v) Some of the ways in which material may have been preserved on Oakbank Crannog.

Appendix G.

Chipped Stone from Oakbank Crannog.

J Kenworthy.

Eight pieces, 2 of rock crystal and 6 of flint have been recovered. All must have been brought to the site intentionally. They are tabulated in the appendix.

1 Flint.

As far as can be ascertained, all the flint came from river cobbles, although it is possible that cat. nos. 2 and 3 might come from some other source. Of the 6 pieces, two are cortical chunks (one calcined) and one is a small burnt chip. These may be evidence for some unspecialized flint-working on site,as they are hardly likely to have been introduced intentionally in their present state. On the other hand they may have been chance inclusions in soil brought on to the site. The former suggestion is perhaps more likely, although a larger assemblage of material would be needed before any certainty is possible. None of the pieces shows significant abrasion by water transport. The other three pieces merit more detailed comment. The first (Cat. no. 1) is the burnt fragment of an edge tool (probably a steep scraper) made on a flake or blade, with c. 10 mm of surviving working edge on the left hand edge. This working edge has an angle of

80 degrees, although in part it overhangs, due to step-flaking in use. A black deposit adhers to the edge in small patches. It comes from the plank floor area. It is most likely that this piece was used, broken and burnt on site.

The second and third pieces are of early Bronze Age type, and were introduced to the site in their present forms, either as curiosities or as magical charms. They are the distal tip of a plano-convex knife and a barbed-and-tanged arrowhead.

The plano-convex knife (Cat. no. 2) was of very high quality. It came from site B, layer 4E, c. 80 cms below the surface of the organic layer. Of greyish-yellow-brown flint, its surviving length is 24 mm, breadth 19 mm and thickness 17.5 mm. Made on a stout flake or blade, the entire dorsal surface of the piece is covered by neat invasive scalar pressure retouch, and the edges appear to have been scrubbed to remove irregularities. The ventral face is unmodified. There may be a slight patination of the surface. The left-hand edge angle is c. 56 degrees, the right-hand edge angle c. 60 degrees. Use is indicated by some scattered dorsal scalar removals but is concentrated for 16 mm towards the distal end of the right-hand edge; here there is heavier direct micro-step flaking, removing the original edge and giving a steep to overhanging profile. The fracture of the piece may have been due to a blow on the dorsal surface; it probably came to the site as a fragment. Such artifacts have associations mainly with Food Vessels and Cinerary Urns, and may be dated to the later part of the Early Bronze Age.

The arrowhead (Cat. no. 3) is of pale-greyish flint. It came from area F layer 4 (upper slip). One barb (the right-hand one) has been partly broken. It is 33 mm long, the surviving breadth is 23 mm, the thickness is 5 mm and the weight 2.45 gms. Pressure-flaking covers both faces, and none of the original flake surface remains. The edges are straight from the tip to a point level with the tops of the barbs, then they curve slightly inwards. They are both finely but irregularly serrated, this being clearer on the right-hand edge. The surviving barb is pointed with a slight internal bevel, and extends 8 mm below the top of the notch. The tang is pointed with rounded angles, and is 10 mm long and 8 mm broad.

This is a small, shaped arrowhead of Green's (1980) Kilmarnock type, a common Scottish form, on which serration is common. The few associations, notably with Encrusted and Collared Urns (Green 1980, 256) suggest a date within the later Early Bronze Age; it would be unwise to assume survival to much later periods on the basis of a date of 930+ _ +90 bc (GaK - 1397) for a cremation associated with two Kilmarnock arrowheads at Grandtully, Perthshire (Green, loc. cit. and 295), given that the same cemetary yielded two Collared Urns and a Cordoned Urn. This last is of interest here, since it contained a large leaf-shaped flint knife related to Oakbank Cat. no. 1 associated with the cremations of three children, and a C14 date of 1270+100 bc. As well as supporting the dating for the Oakbank piece, this is also likely to be a truer reflection of the age of the arrowheads. A survival of this type of arrowhead into the 'Middle Bronze Age' is possible, but it is unlikely that they survived into

the later prehistoric period as more than curios or objects of potency, picked up by chance.

2 Rock Crystal and related.

A chunk of fine rock crystal from area E, layer 4c (Cat. no. 7), and a small flaked pebble of greenish-yellow translucent quartz from the stony layer (Cat. no. 8) seem to be deliberate introductions to the site, presumably on account of the attractiveness of the stone. No more can be said about them.

Catalogue.

1. (OB81. Acc. no. 95; plank floor area, F17). Flint edge-tool fragment (scraper?). 21 mm long, 11 mm broad and 3.5 mm thick. Burnt. Flint, brown (c. 7.5YR 5/2). For further details see main text. Undiagnostic.

2. (OB82. Area B, layer 4c; 80 cms below organic layer surface). Distal tip of plano-convex knife, 24 mm long, 19 mm broad and 17.5 mm thick. Flint, pale brown (10YR 6/3.5). For further details see main text. Early Bronze Age.

3. (OB82. Acc. no. 249. Area F, layer 4 - upper slip). Barbed and tanged arrowhead of Kilmarnock type. 33 mm long, 23 mm

broad, 5 mm thick. Weight 2.45 gms. Flint, pale greyish (c. 10YR 7/2 to 7/3). For further details see main text. Early Bronze Age.

4. (OB80. Acc. no. 34; Area B, layer 4b). Cortical chunk, slightly worn, 29 mm x 21 mm x 12.5 mm. Calcined flint. Three removals from the non-cortical face suggest production during un-specialised flint working. Undiagnostic.

5. (OB81. F23). Cortical chunk, 28mm x 21mm x 14mm. Flint, yellowish-brown (7.5YR 4/4) with 10YR 5/6 inclusions. Nodule from which it came possibly heated before fracture. 6 dorsal removals show some pattern, and this piece might possibly be a very crude core; it certainly comes from flint-working. Undiagnostic.

6. (OB81. Acc. no. 13; Area E, layer 3/4). Chip, worn, 12mm x 8mm x 4mm. Flint, burnt. Undiagnostic.

7. (OB81. Acc. no. 196; Area E, layer 4c). Chunk of high quality clear rock crystal, 25mm x 15mm x 8.5mm. The piece is clearly not waterworn, and the presence of irregular flake scars suggests human agency as the reason for it being on site. Undiagnostic.

8. (OB81. F23). Small pebble of translucent greenish-yellow quartz, mainly retaining water-worn cortex, but it has been flaked at both ends, probably intentionally. Undiagnostic.

Reference.

Green, H.S., 1980. 'The Flint Arrowheads of the British Isles',
in British Archaeological Reports, Brit. Ser., 75.

Appendix H.

Radiocarbon dates from Loch Tay.

Oakbank Crannog.

GU-1323 Oakbank OB2 Wood 2545±55 bp d13C = -25.9‰

Top of oak pile (103) in area B, part of F10.

GU-1325 Oakbank OB1 Wood 2410±60 bp d13C = -25.8‰

Top of oak pile set into loch bed in angle between main mound and extension, south of main mound and east of extension. Possibly associated with extension but notably of oak while other piles surrounding the extension are alder. (see fig 15).

GU-1463 Oakbank OB3 Wood 2360±60 bp d13C = -23.9‰

Small stake point set into very top of main organic deposit in area D. Only 10 - 15 cms of point remained indicating high level insertion. Alder.

GU-1464 Oakbank OB4 Wood 2405±60 bp d13C = -24.5‰

Same group and closely associated with OB3.

Other Loch Tay dates.

GU-1322 Fearnan Hotel FH1 Wood 2475±55 bp d13C = -25.6‰

Crannog No. 4 (see Appendix A). Top of pile from top

of crannog mound embedded in organic deposit beneath boulders about 3 m from west edge.

GU-1324 Firbush FB1 Wood 2140±55 bp d13C = -26.6‰

Crannog No. 11 (see Appendix A). End of horizontal timber projecting from base of mound at loch bed level. Part of array of 3 layers of timbers extending c. 6m around base.

Other Related Dates.

K-1394 Milton Loch 1 Wood 400±100 bc

Ard head of bow ard from living floor (Piggott 1953).

K-2027 Milton Loch 1 Wood 490±100 bc.

Rings 30 - 50 from a pile of 70 rings width.

K-1867 Lochmaben Wood 80±100 bc.

Ard beam from moss not directly associated with crannog though site recognised nearby.

UB-2415 Loch Awe Wood 370±45 bc.

Timber from extensive array on top of mound underlying boulders and embedded in organic deposit. Date from 100 rings into timber. Crannog No. 20 (see Appendix A).